

Soft Tissue Cephalometric Norms for Central India (Malwa) Female Population

Shweta Raghav¹, Kamalshikha Baheti¹, Varun Hansraj², Mohamed Rishad³, Himanshu Kanungo⁴, Pulayampatt Unni Bejoy⁵

Contributors:

¹Senior Lecturer, Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India; ²Assistant Professor, Department of Orthodontics, Qassim Private College, Ministry of Higher Education, Kingdom of Saudi Arabia; ³Senior Lecturer, Department of Orthodontics, Malabar Dental College, Manoor, Edappal, Malappuram, Kerala, India; ⁴Reader, Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India; ⁵Professor, Department of Orthodontics, Annor Dental College, Puthuppaday, Muvattupuzha, Ernakulam, Kerala, India.

Correspondence:

Dr. Raghav S. Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India. Email: shwetaraghav4u1@gmail.com

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Abstract:

Background: The various soft tissue traits that contribute to an aesthetically pleasing face. This should be considered during orthodontic treatment. The aim of the present study was to propose soft tissue norms for Central Indian (Malwa) female population.

Materials and Methods: Facial photographs of 78 patients of age group 18-26 years were taken in Department of Orthodontics, Rau, Indore, which were then subjected to a selection process and 30 top scorers (30 females) were selected. Lateral cephalograms of individuals were taken and soft tissue profile as well as related osseous and dental structures standard tracing were made on the acetate matte tracing paper. Then eighteen soft tissue traits were studied as described by Bergman.

Results: The present study showed that, a mild convexity of the face and the resulting tendency toward Class II in females is acceptable esthetically. A fuller upper lip is considered balanced and esthetic. Increase in lip incompetency is considered unaesthetic.

Conclusion: A mild convexity of the face and the resulting tendency toward Class II in females is acceptable esthetically. Individual norms are necessary for a population in order to plan and deliver quality treatment.

Key Words: Female, soft tissue traits, treatment planning

Introduction

Preservation of facial attractiveness is a primary goal of orthodontic treatment. Treatment planning requires knowledge of the parameters and normative data that helps to establish goals and predict the obstacles that need to be negotiated.

As we know the norms attained by various analyses are based on foreign sample.¹⁻⁸ Due to a complicated interaction of genetic and environmental factors the morphological features of an individual vary from race to race. Even within the same race, each subgroup had its own standards. Hence, the established norms for other ethnic group can not apply to the Indian population. For the improvement of facial esthetics, Arnett and Bergman discussed cephalometric soft tissue facial analysis with eighteen soft tissue traits.²

Indian population is polygenetic and is an amalgamation of various races and cultures. Hence, the established norms for other ethnic group can not apply to the Indian population. Therefore, the applicability of various soft tissue parameters proposed by Bergman, should be analyzed which will improve treatment planning for Central Indian and specifically local Malwa population. Norms of measurements serve as a guideline in calculating change.²

The present study was attempted:

1. To propose soft tissue norms for Central Indian specifically local Malwa female population
2. To correlate the soft tissue cephalometric norms with that of Bergman.

Materials and Methods

1. The study was conducted on 78 young adult females of age group 18-26 years
2. Healthy subjects with good balance and harmony of dentofacial structures were included
3. The subject had to be of Central India (Malwa female) background for at least one prior generation that is both parents have to be of Central India (Malwa) background
4. All the subjects selected had a full set of a permanent dentition with no history of previous orthodontic treatment.

Facial photographs of the 78 female subjects of age group 18-26 years were taken using Nikon DSLR D3100 digital Camera. Photographs were taken with subject standing in natural head posture with subject camera distance kept constant (3 feet). The photographs were then enhanced and standardized using Adobe Photo Shop CS2 software (Adobe Systems Inc.). Facial photographs of the group were evaluated and selected by a panel of judges. Points given to individual subject were then added and top 30 scorers females were selected from the above group.

The lateral cephalograms of the 30 selected individuals (30 females) obtained from department of orthodontics, College of Dental Sciences and Hospital, Indore had been taken by properly positioning the patient on a universal counterbalancing type of cephalostat with the floor and the teeth in centric occlusion and parallel to Frankfort horizontal plane relaxed lips.

Kodak X-ray films (8" × 10") had been exposed at 80 Kvp; 10 mA, 0.8 s from a fixed distance of 60 inches by following the standard technique employed. All cephalograms were taken with the same cephalometric radiographic unit. All cephalometric radiographs were traced on an acetate paper of 0.5 µm (micron) thickness with sharp 3H pencil on a view box.

Soft tissue profiles, as well as related osseous and dental structures of lateral cephalogram tracing, were made using 3H pencil on an acetate matte tracing paper of thickness 0.003 cm. Then eighteen soft tissue traits were studied as described by Bergman: Facial profile angle, nasolabial angle, lower face - throat angle, maxillary sulcus, mandibular sulcus, nasal projection, lower face height, upper lip length, upper lip thickness, upper lip protrusion, upper incisor exposure, interlabial gap, lower lip - chin length, lower lip thickness, lower lip protrusion, soft tissue B point-subnasale soft tissue pogonion, throat length and lower face percentage.

Observation

The lateral cephalograms were subjected to soft tissue facial analysis as described by Bergman.¹ The various soft tissue cephalometric values which were derived from the tracings were put in together and master charts were prepared. For ease of assessment all the 18 cephalometric soft tissue parameters were studied under: Angular parameters, linear parameters and proportional parameters (Figures 1-6).

Statistical analysis was performed to calculate the mean and standard deviation of each variable for female. Student's *t*-test was used to calculate the equality of two means (Table 1).

Various variables derived were compared graphically using bar graphs. Bar graph represents the relative comparison between the various variables or various conditions of a single variable. The difference in the height of two bars in the graph immediately gives the idea of the difference between two variables or conditions (Graphs 1 and 2).

Results

Statistical analysis was performed to calculate the mean and standard deviation of each variable for females. Student's *t*-test was used to calculate the equality of two means. Female soft tissue mean values were compared with standard norms.

For angular measurements, the mean facial angle was seen to be $161.98^\circ \pm 5.42^\circ$ with a range of 152.0-173.0°, nasolabial angle

Table 1: Mean soft tissue parameters (females).

Parameter	Mean	SD	Range
Angular (In degree)			
Facial angle	161.98	5.42	152-173
Nasolabial angle	108.37	9.06	86.5-122
Linear (In millimeter)			
Nasal projection	13.28	1.54	10-15.5
Lower face height	69.62	4.92	55.5-76.5
Upper lip length	21.85	2.41	16.5-26
Upper lip thickness	13.45	1.45	10.5-16.5
Upper lip protrusion	2.97	1.47	0-6
Upper incisor exposure	3.68	1.18	1-5.5
Interlabial gap	0.33	0.61	0-2
Lower lip-chin length	47.58	3.28	39-54
Lower lip thickness	13.33	0.94	11.5-15
Lower lip protrusion	2.23	2.01	-3-6
B'-SnPg' line	3.67	1.75	0-6.5
Throat length	56.77	6.25	44-69.5
Proportion			
Lower face%	50.23	2.65	43.24-54.09

SD: Standard deviation

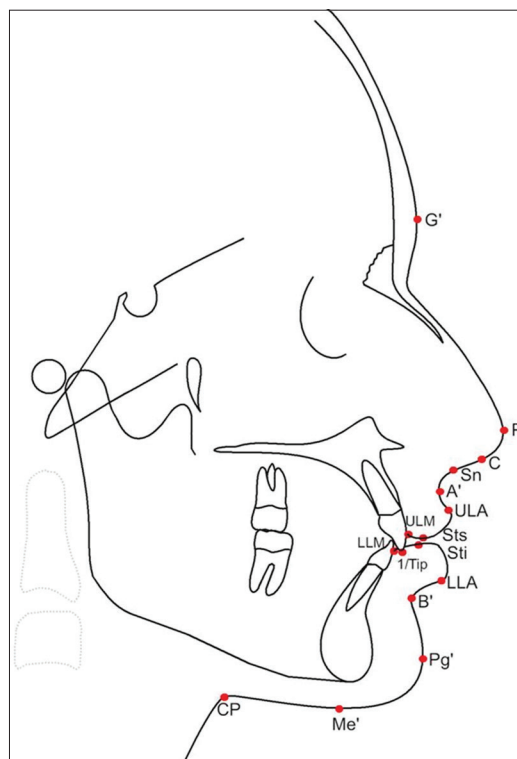


Figure 1: Tracing of lateral cephalogram showing soft tissue landmarks. Soft tissue glabella (G'), pronasale (P), columella (C), subnasale (Sn), soft tissue A point (A'), upper lip anterior point (ULA), tip of upper incisor (1/Tip), stomium superior (Sts), upper lip mucosa side opposite A' (ULM), stomium inferior (Sti), lower lip anterior point (LLA), soft tissue B point (B'), lower lip mucosa side opposite B' (LLM), soft tissue pogonion (Pg'), soft tissue menton (Me'), cervical point (CP).

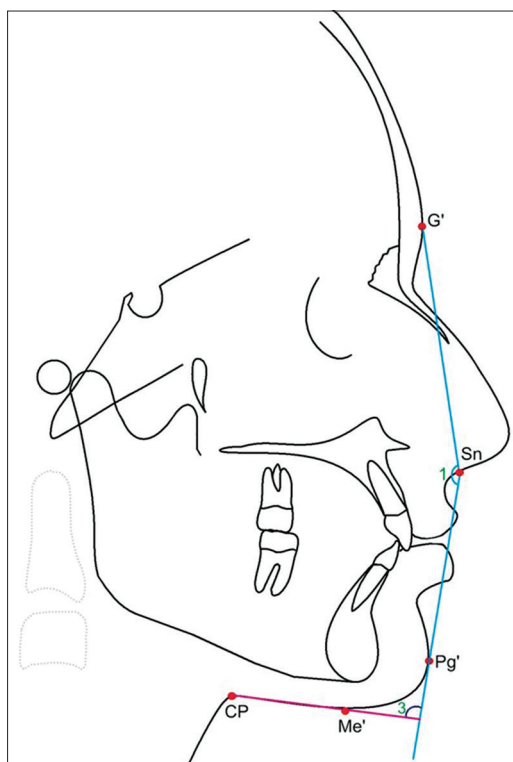


Figure 2: Tracing of lateral cephalogram showing angular parameters : Facial angle (1) and Lower face – Throat angle (3). Soft tissue glabella (G'), subnasale (Sn), soft tissue pogonion (Pg'), soft tissue menton (Me'), cervical point (CP).

was $108.37 \pm 9.06^\circ$ (range 86.5-122.0°), lower-face throat angle to be $109.73 \pm 8.95^\circ$ (range 96.0-130.0°), maxillary sulcus angle to be $131.83 \pm 13.65^\circ$ (range 111.5-160.0°) and mandibular sulcus angle to be $118.23 \pm 16.18^\circ$ (range 79.0-142.0°).

The linear measurements (In millimeters) for nasal projection revealed a mean value of 13.28 ± 1.54 (range 10.0-15.5), lower face height to be 69.62 ± 4.92 (range 55.5-76.5), upper lip length to be 21.85 ± 2.41 (range 16.5-26.0), upper lip thickness 13.45 ± 1.45 (range 10.5-16.5), upper lip protrusion to be 2.97 ± 1.47 (range 0.0-6.0), upper incisor exposure to be 3.68 ± 1.18 (range 1.0-5.5), the interlabial gap was 0.33 ± 0.61 (range 0.0-2.0), lower lip-chin length 47.58 ± 3.28 (range 39.0-54.0), lower lip thickness was 13.33 ± 0.94 (range 11.5-15.0), lower lip protrusion was 2.23 ± 2.01 (range -3.0-6.0), B'-SnPg' line was 3.67 ± 1.75 (range 0.0-6.5) and throat length was 56.77 ± 6.25 mm (range 44.0-69.5 mm). Facial proportions showed lower face % to be $50.23 \pm 2.65\%$ with a range of 43.24-54.09%.

Discussion

The facial skeleton and its overlying soft tissue determine facial harmony and balance. It is the structure of the overlying soft tissues and their relative proportions that provide the visual impact of the face.⁹

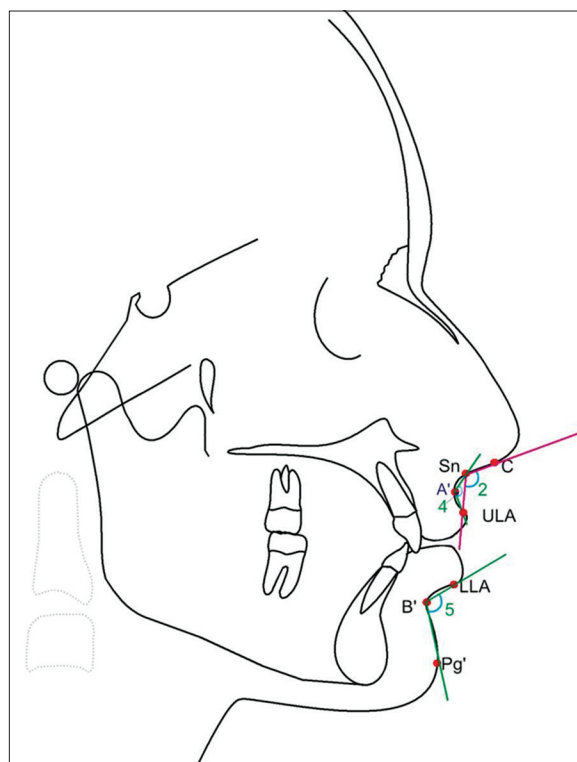
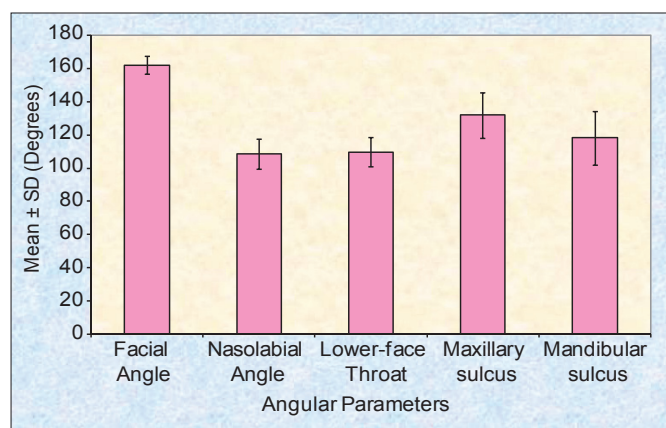


Figure 3: Tracing of lateral cephalogram showing angular parameters: nasolabial angle (2), maxillary sulcus (4) and mandibular sulcus (5). Columella (C), subnasale (Sn), soft tissue A point (A'), upper lip anterior point (ULA), Lower lip anterior point (LLA), soft tissue B point (B'), soft tissue pogonion (Pg').



Graph 1: Mean soft tissue parameters (females).

Relying on cephalometric dentoskeletal analysis for treatment planning can sometimes lead to esthetic problems. The dentoskeletal pattern may be an inadequate guide in evaluating facial disharmony since the soft tissue covering the teeth, and bones can vary. Therefore in a lateral cephalometric facial profile analysis, soft tissue profile must be included along with measurement of the skeletal structure.¹

The lateral cephalograms of the 30 selected individuals (30 females) obtained from Department of Orthodontics,

College of Dental Sciences and Hospital, Indore had been taken by properly positioning the patient on a universal counterbalancing type of cephalostat. The lateral cephalograms

were subjected to soft tissue facial analysis as described by Bergman.¹ Soft tissue analysis was done with 13 points along

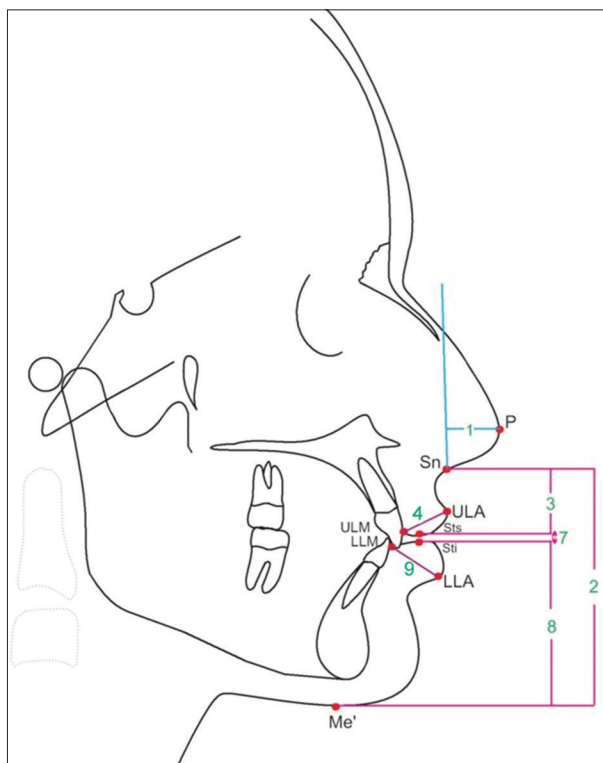


Figure 4: Tracing of lateral cephalogram showing linear parameters Nasal projection (1), Lower face height (2), upper lip length (3), upper lip thickness (4), interlabial gap (7), lowerlip - chin length (8) and lower lip thickness (9). Pronasale (P), subnasale (Sn), upper lip anterior point (ULA), upper lip mucosa side opposite A' (ULM), stomium superior (Sts), stomium inferior (Sti), lower lip anterior point (LLA), lower lip mucosa side opposite B' (LLM), soft tissue menton (Me').

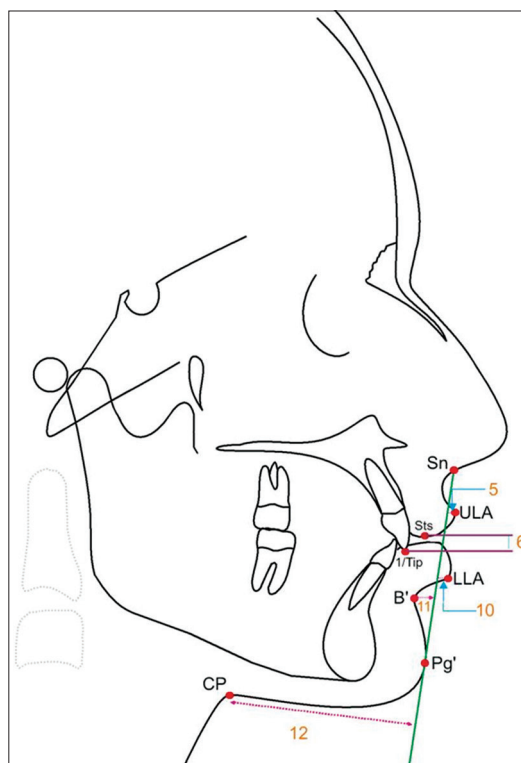
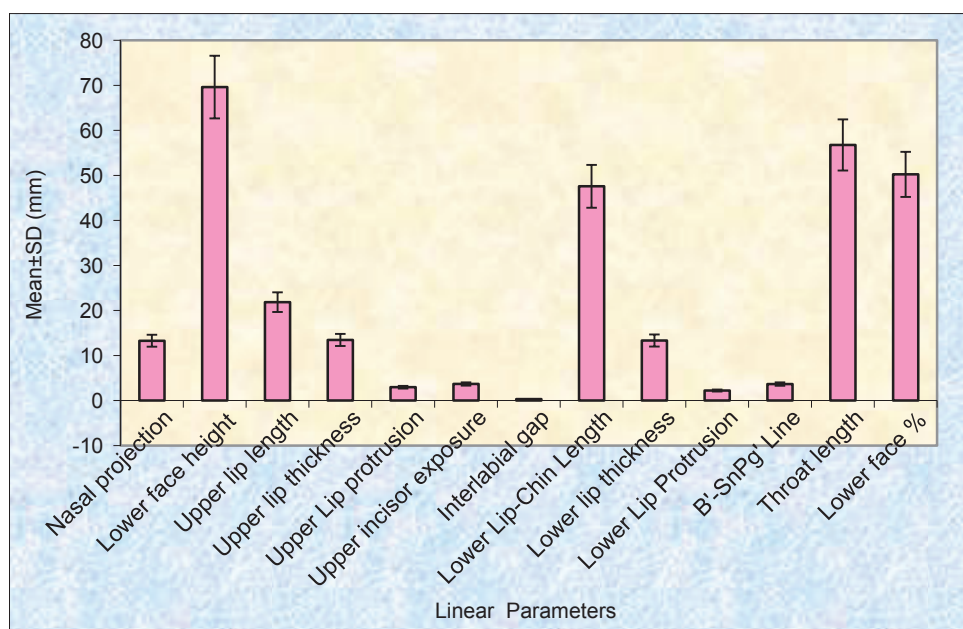


Figure 5: Tracing of lateral cephalogram showing linear parameters. Tracing of lateral cephalogram showing linear parameters: Upper lip protrusion (5), upper incisor exposure (6), lower lip protrusion (10), soft tissue B point - Subnasale soft tissue pogonion (11) and throat length (12). Lower lip anterior point (LLA), upper lip anterior point (ULA), stomium superior (Sts), tip of upper incisor (1/Tip), cervical point (CP), soft tissue point (B'), soft tissue pogonion (Pg'), subnasale (Sn).



Graph 2: Mean soft tissue linear parameters (females).

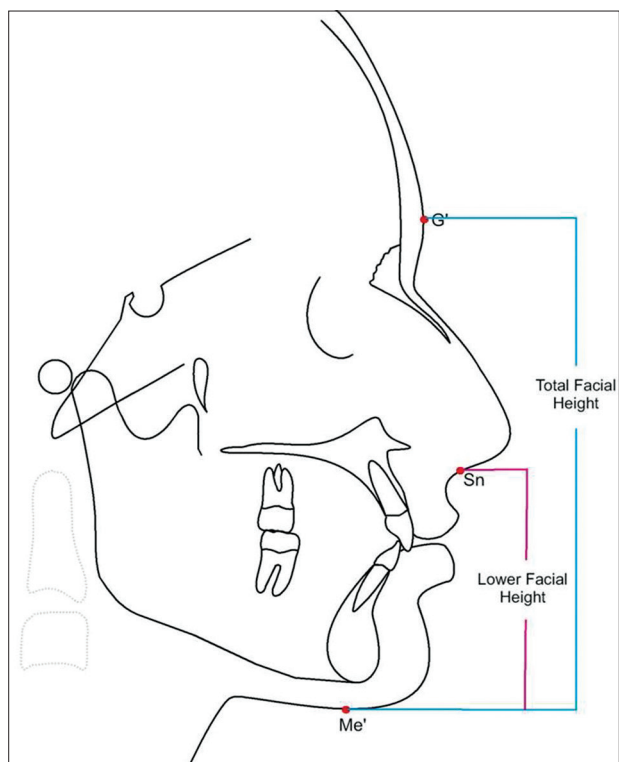


Figure 6: Tracing of lateral cephalogram showing proportional parameter:

$$\text{Lower face\%} = \frac{\text{Lower facial height}}{\text{Total facial height}} \times 100$$

Soft tissue glabella (G'), subnasale (Sn), soft tissue menton (Me').

the facial profile, 2 points on the labial mucosa, and the tip of the upper incisor.

Angular parameters

Facial profile angle

As Facial profile angle decreases, it is suggestive of a Class II dental and skeletal pattern. Maxillary protrusion, vertical maxillary excess and mandibular retrusion all has low profile angles. When the angle increases, there is an increase in the tendency toward the Class III dental and skeletal profile pattern. Maxillary retrusion, vertical maxillary deficiency, and mandibular protrusion can all show increased profile angles.¹

In the present study, the mean value is 161.98 (standard deviation [SD] = 5.42). In the present study the values of facial profile angle are slightly less with the reference range of 165-173° (Bergman's study) and lower compared to Burstone⁵ (168.7° ± 4.1°), Legan and Burstone¹⁰ (168.0° ± 4.0°), Nanda *et al.*¹¹ (165° ± 4.5° for females) in Caucasian population and Ioi *et al.*¹² (166.8° ± 4.9° for females) in Japanese population.

Our study suggests that a slightly convex facial profile is acceptable in our population, whereas in the Caucasian

population a slightly straighter facial profile is considered agreeable.

Naso-labial angle

The nasolabial angle is useful in evaluating the anteroposterior position of the maxilla. Low nasal tip position and thick maxillary lip are also the reasons for an acute angle; an obtuse angle suggests a maxillary retrusion or maxillary dental retrusion with a need for maxillary advancement or the advancement of the maxillary incisors, or both.¹³ Increased angles can be either due to an upturned nose or to lips that slant back.¹

The mean value of naso-labial angle is 108.37° (SD = 9.06°) for females. The values of naso-labial angle from our study are in close proximity with the reference range of 94-110° (Bergman's study). Our values are comparable to the values given by Genecov *et al.*¹⁴ (108.3 ± 11.8° for females), Burstone⁶ (106.0 ± 8.0°) and Zylinski *et al.*¹⁵ (110.0 ± 7.6°). However, our values are less than those given by Nandini *et al.*¹⁶ (114.08 ± 9.58°, with a range of 91.4-138.97°), Formby *et al.*¹⁷ (114.08° for females) in Caucasian population.

Our study indicates that the naso-labial angle in Malwa population is similar to the Caucasian population.

Lower face-throat angle

It is the angle formed by the subnasale - pogonion line and the throat line.¹ It is helpful in determining the position of the lower face in relation to the chin. In prognathic mandibles, it will tend to be acute; in retrognathic mandibles, this angle is obtuse. This angle is critical in anteroposterior facial dysplasias. An obtuse angle should warn against procedures that reduce the prominence of the chin excessive submental fat contributing to the bulk of neck or low hyoid bone position through its mechanical location and attachment of submental musculature increase the angle.¹⁸

The present study showed a mean value of 109.73° (SD = 8.95°) for females. The mean value of lower face-throat angle for females is comparable with the reference range of 96-110° (Bergman's study).

Maxillary sulcus

The maxillary sulcus contour is normally a gentle curve. The angle of the maxillary contour can be measured from the subnasale to the soft tissue point A to the anterior point of the upper lip.¹ It gives information regarding upper lip tension. Lip tension can cause the sulcus contour to flatten, whereas a flaccid lip have an accentuated curve and are often thick and creates a curve with the accentuation of curve at vermilion lip area. The flaccid lip is generally thick, which gives the lip appearance of being too far forward compared to the teeth.

Our study shows that the mean value is 131.83° (SD = 13.65°) for females. The values of maxillary sulcus in the present study are lower compared with the reference range of $127-147^\circ$ (Bergman's study).^{1,2} Our values are also more compared to the values given by Arnett and Bergman² (122.7°). However, our values are less than those given by Burstone⁵ ($136.9^\circ \pm 10^\circ$).

Our study suggests that angulation of maxillary sulcus in our population is slightly less compared with a Caucasian population, indicating a thicker upper lip in our sample.

Mandibular sulcus

The mandibular sulcus contour is a gentle curve. A measurement of this curve can be taken by measuring the angle formed by lower lip anterior (LLA), soft tissue point B, and soft tissue pogonion.¹

Our study shows that the mean value is 118.23° (SD = 16.18°) for females. The values of mandibular sulcus from our study are in close proximity but slightly lesser when compared to the reference range of $110-134^\circ$.^{1,2}

Results from our study demonstrate that our values are less compared to the values given by Zylinski *et al.*¹⁵ ($124.3^\circ \pm 13.1^\circ$), Burstone⁵ ($122.0^\circ \pm 11.7^\circ$), In comparison to most studies^{5,12,15,17,19} it is found that a mildly reduced mandibular sulcus contour in our population is acceptable.

Linear parameters

Nasal projection

It is measured horizontally from the subnasale to the nasal tip.¹ Maxillary anteroposterior position is indicated by nasal projection. This length is important for anterior movement of the maxilla while maxillary advancement is contraindicated with decreased nasal projection. A large nose accentuates a receded chin.²⁰

In our study the mean value is 13.28 mm (SD = 1.54 mm) for females. The values of nasal projection are in close proximity with the reference range of $13-18$ mm (Bergman's study) in the present study. Our values are also comparable to the values given by Burstone⁷ (15.5 ± 2.8 mm), Holdaway's⁸ (range of nasal projection is $14-24$ mm) in the Caucasian population.

The approximation of values suggests that the nasal projection is a feature whose esthetic acceptance is similar among Caucasians, as well as the sample we studied.

Lower facial height

The lower facial height is the lower one-third of the face. The face divides vertically into thirds, one-third from hairline to midbrow, one-third from midbrow to subnasale and the lower third from subnasale to soft tissue menton.¹

Our study shows that the mean value is 69.62 mm (SD = 4.92 mm) for females. The values of lower facial height from our study are in close proximity, but on the higher side with the reference range of $57-74$ mm.^{1,2} Our values are slightly more than those given by Arnett and Bergman² ($60-68$ mm).

The values of lower facial height from our study are in close proximity, but on the higher side with the reference range of $57-74$ mm, signifying that our esthetic acceptance of lower face height dramatically decreases with a decrease in this parameter.

When both lower face percentage and height are considered simultaneously, our study shows a decreased lower face percentage in spite of normal lower facial height because upper face height (soft tissue glabella to subnasale) in our population is comparatively more.

Upper lip length

The upper lip length is measured in a relaxed-lip position. The average length is from subnasale to stomium superius.¹ Short upper lip can cause a "gummy" smile, while long lips make it difficult to see the maxillary incisors. Excessively long lip length will often be associated with lip redundancy.

Present study shows that the mean value is 21.85 mm (SD = 2.41 mm) for females. The results from the present are in agreement with studies done with esthetics appraisal^{1,7,15,16} in mind than studies done to derive normal values.^{2,17,21}

Upper lip thickness

It is measured at the vermilion border to the inner lining of the lip.¹ The vertical relationship between lips and anterior teeth, particularly the maxillary incisors is an important factor relative to esthetics and stability of treatment. However, it is the thickness of lips and hence the fullness of the lower part of the facial profile that influences treatment decisions, particularly when extractions of teeth and incisal retractions are considered.²⁰

A thick lip generally gives the appearance of being too far forward relative to the teeth. With a thick upper lip, it becomes questionable to protrude the upper lip by advancing the upper incisors.

Our study shows that the mean value is 13.45 mm (SD = 1.45 mm) for females. The mean value of upper lip thickness from our study of females is in close proximity with the reference range of $10-14$ mm (Bergman's study). Our values are comparable to the Mamandras²⁰ (12.50 ± 1.58 mm for females). However, our values are less than the values given by Genecov *et al.*¹⁴ (16.9 ± 2.1 mm for females).

Results of our study in comparison to most of the studies conducted are considerably higher in upper lip thickness, suggesting slightly thicker upper lips are considered more esthetic in our population than they are in Caucasians.

Upper lip protrusion

It is the distance between the upper lip anterior and the subnasale-pogonion line.¹ Upper lip protrusion helps in orthodontic soft tissue analysis and treatment planning.

The present study shows that the mean value of upper lip protrusion is 2.97 mm (SD 1.47 mm) for females. The values of upper lip protrusion in our study are comparable to the reference value of 3 mm ± 1 mm (Bergman's study). Our values are also similar to those observed by Park and Burstone²¹ (2.8 ± 1.95 mm) and Legan and Burstone⁵ (3.0 ± 1.0 mm), by Burstone⁷ (3.5 ± 1.4 mm) and. Values in the present study are less compared with the values observed by Ioi *et al.*¹² (6.5 ± 1.5 mm for females) for Japanese population.

This suggests that protrusion of upper lip in our population is esthetically acceptable similar to the Caucasians population.^{5,7,22} However, Japanese population¹² shows more upper lip protrusion than our population. This demonstrates the ethnic and racial variation in this parameter.

Upper incisor exposure

It is the vertical distance from the inferior border of the upper lip to maxillary incisal edge.¹ This is a critical measurement on which much of the vertical planning for surgical and orthodontic treatment depends. Conditions of disharmony are produced by four variables:

- Changes in maxillary skeletal length (frequently)
- Changes in upper lip length (infrequently)
- Thick upper lips expose the incisor less than thin upper lips, with equal all other factors.

The three variables that contribute to the angle of view are (1) height of the patient, (2) the observer's height, and (3) the distance from the facial surface of the upper lip to the incisive edge (increased lip thickness indicates less relative tooth exposure).²⁰

Our study shows that the mean value is 3.68 mm (SD = 1.18 mm) for females. The mean values of upper incisor exposure from our study are in close proximity compared to the reference range of 1-5 mm (Bergman's study). Our values for females are comparable to the values given by McCollum²³ (3-5 mm for females). However, our values are less compared to Peck *et al.*²² (4.7 ± 2.0 mm for females).

The approximation of values from our study suggests the upper incisor exposure values corroborate with that of the Caucasian population.

Inter-labial gap

It is the distance between the inferior border of the upper lip and the upper border of the lower lip.¹

The results from our study show that the mean value is 0.33 mm (SD = 0.61 mm) for females. The values of inter-labial gap from our study are less compared with the reference range of 1 mm - 5 mm (Bergman's study). Our values are also less in comparison to the values given by Burstone⁷ (1.8 ± 1.2 mm), by Peck *et al.*²² (2.6 ± 3.2 mm for females), by Legan and Burstone¹⁰ (2.0 ± 2.0 mm) and by Arnett and Bergman² (1-5 mm).

In our study, it is found that in Malwa population, none to little Inter-labial gap is esthetically acceptable, whereas studies by different workers^{2,7,10,24} show that interlabial gap or lip incompetency up to 6 mm²⁴ is agreeable in the Caucasian population.

Lower lip-chin length

It is measured from the superior border of the lower lip to the soft tissue menton.¹ The normal ratio of upper to lower lip is 1:2.1.⁷ Disproportionate lips may need length modification to appear in the balance. Lip measurements identify normal or abnormal soft tissue length that can be related to dentoskeletal length, either excess or deficiency.

We observed that the mean value of lower lip- chin length 47.58 mm (SD = 3.28 mm) for females. The values in our study are comparable to the reference range of 43 mm - 50 mm for females (Bergman's study). Our study demonstrates that our values are comparable to the values given by Burstone⁷ (46.4 ± 3.4 mm for females). Our values are less than Genecov *et al.*¹⁴ (51.9 ± 3.4 mm for females) and Zylinski *et al.*¹⁵ (57.5 ± 3.0 mm). However, our values are more when compared to the values given by Mamandras²⁰ (40.15 ± 3.72 mm for females) and by Arnett and Bergman² (38-44 mm).

Our study indicates that in Malwa population the lower lip-chin length values are comparable to the range, normal for a Caucasian population. However, the opinion on normal values of this parameter differs with different studies^{2,7,14,15,21} even though all of them were done on Caucasian population.

Lower lip thickness

It is measured at the vermilion border to the inner lining of the lip.¹ A study conducted shows that the mean value of lower lip thickness is 13.33 mm (SD = 0.94 mm) for females. The mean values in our study are comparable to the reference range of 11-15 mm (Bergman's study). Our values are also comparable to Formby, *et al.*¹⁷ (13.24 mm for females). As the comparison demonstrates that lower lip thickness is a

feature whose esthetic acceptance is similar in our population as well as in Caucasians.

Lower lip protrusion

It is the distance between the LLA and the subnasale-pogonion line. The lower lip to subnasale-pogonion line should also be about 1 mm less than the upper lip to subnasale-pogonion line measurement.¹

In the present study, the mean value of lower lip protrusion is 2.23 mm (SD = 2.01 mm) for females. The values of lower lip protrusion from our study are in close proximity to the reference range of 2 mm \pm 1 mm (Bergman's study). Our values are also comparable to those by McCollum²³ (2.2 \pm 1.6 mm), and Park and Burstone²¹ (1.8 \pm 1.52 mm). Results from our study demonstrate that our values are less compared to the values given by Ioi *et al.*¹² (6.4 \pm 1.9 mm for females) for Japanese population.

Our study indicates that in Malwa population the lower lip protrusion values are comparable to the range normal for Caucasian population^{1,22,23} but the Japanese population¹² shows more lower lip protrusion than us. Our study indicates that esthetic acceptability reduced with an increase in lower lip projection in North Indian subjects.

Soft tissue B point-subnasale soft tissue pogonion

The soft tissue B point-subnasale soft tissue pogonion is the distance of the soft tissue B point to the subnasale soft tissue pogonion line.¹

The present study shows that the mean value is 3.67 mm (SD = 1.75 mm) for females. The mean values of soft tissue B point-subnasale soft tissue pogonion are in close proximity with the reference value of 4 mm \pm 1 mm (Bergman's study). Results from our study demonstrate that our values are comparable to the values given by Arnett and Bergman² (4.0 mm).

The present study showed that in Malwa population the soft tissue point B, point-subnasale and soft tissue pogonion is comparable with the Caucasian population.^{1,2}

Throat length

It is the distance measured from the neck-throat junction (cervical point [CP]) to the intersection of the subnasale-soft tissue pogonion and the throat line.¹

The present study shows that the mean value of throat length is 56.77 mm (SD = 6.25 mm) for females. The values of throat length are similar to the reference range of 51-63 mm (Bergman's study). Our study demonstrates that our values are comparable to the values given by Worms *et al.*²⁴ (57.0

\pm 6.0 mm) they took the throat length from the neck- the throat junction (CP) to the soft tissue menton. However, our values are more than McCollum²³ (38-42 mm in females and 40-45 mm in males).

The approximation of values suggests that throat length is a feature whose esthetic acceptance is similar in Caucasians^{1,2} as well as in our population.

Proportional parameter

Lower Face percentage

The lower face percentage is used to establish the proportion for the lower facial height. The lower face height is measured from the subnasale vertically to the soft tissue menton. The percent is the total face height measured from soft tissue glabella vertically to soft tissue menton.¹ The lower face percentage is relatively constant throughout development. It is extremely important to control the vertical dimension in patients with excessive lower face heights.

In the present study, mean value of lower face percentage is 50.23% (SD = 2.65%) for females. The values of the lower face percentage from our study are less than the reference range of 53-56% (Bergman's study).

There decreased lower face percentage showed by females of our population despite having normal lower face height. These findings demonstrate that a slightly decreased lower face % and a mild increase in upper face height (G-Sn) are, esthetically more acceptable in our population when compared to Caucasian population.

Conclusion

The present study showed that a mild convexity of the face and resulting tendency towards Class II in females is acceptable esthetically, and individual norms are necessary for a population in order to plan and deliver quality treatment. More studies with larger sample size and longitudinal studies are needed for further research in this important clinical field.

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