CEPHALOMETRIC SOFT TISSUE ANALYSIS OF INDIVIDUALS WITH PLEASANT FACES

Dr. Jitender Singh, P.G. Student
Post Graduate Department of Orthodontics,
Sardar Patel Institute of Dental and Medical Sciences, Lucknow.

Prof. Praveen Mehrotra, M.D.S. (Lko)
Principal and Head, Post Graduate Department of Orthodontics,
Sardar Patel Institute of Dental and Medical Sciences, Lucknow.

Prof. Sudhir Kapoor, M.D.S. (Lko)
Professor, Post Graduate Department of Orthodontics,
Sardar Patel Institute of Dental and Medical Sciences, Lucknow.

Prof. Ragni Tandon, M.D.S. (Lko)
Professor, Post Graduate Department of Orthodontics,
Sardar Patel Institute of Dental and Medical Sciences, Lucknow.

Dr. Harish Dattada, M.D.S.
Reader, Post Graduate Department of Orthodontics,
Sardar Patel Institute of Dental and Medical Sciences, Lucknow.

Abstract
The aim of our study was to establish an organized, comprehensive approach to soft tissue facial analysis based on facial attractiveness in Lucknow population and to correlate the applicability of the norms established by Bergman's study. Finally, it was also our aim to propose any alteration in treatment objectives in relation to soft tissue goals applicable specifically to Lucknow population.

A sample of 60 divided equally between sexes was short-listed by judges of related professions from an overall sample of 100 subjects with reasonable pleasant faces. These were subjected to cephalometric soft tissue facial analysis as described by Bergman. Applicable statistical analyses were performed (student 't' test). Apart from re-emphasizing the spectra of variations the soft tissue covering of the face is capable of, our study highlights increased esthetic appeal of straighter profile in women, acceptance of mild facial convexity, fuller upper lip and decrease lower face percentage, as well as the intolerance towards increasing lip incompetence in both sexes. The study stresses on the requirement of research to be focused on development of norms for indigenous populations in order to delineate optimal treatment guidelines.

Keywords
Esthetics, soft tissues, facial profile

INTRODUCTION
One of the primary aims of an orthodontic treatment is to attain and preserve facial attractiveness. In the past, the importance of esthetics was discounted in favour of concepts such as function, structure and biology. But in fact if a treatment plan does not begin with a clear view of its esthetic impact on the patient, then the outcome can be disastrous. Traditionally, orthodontic treatment has relied predominantly on dentoskeletal analysis, from which the outcome of soft tissue was predicted. However, with the development and advancement in the field of Orthodontics, it was found that the orthodontist should recognize the facial disharmonies and treat the patient according to the patient's esthetic preferences and not just the bite correction alone.

The soft tissue covering the teeth and bones can vary so greatly that the dentoskeletal pattern may be an inadequate guide to evaluate the facial disharmony. Knowledge of soft tissue traits and their normal ranges can help to formulate a treatment plan designed to normalize facial traits for a given individual. Allowances can be made to maintain the variations in facial attractiveness while maintaining familial ethnic characters.

Wuerpel E.H. (1937) talked about the various soft tissue changes that should be considered during the orthodontic treatment and not just only move the teeth
without thinking of the soft tissue facial outcome after the orthodontic treatment.

Ricketts R.M. (1957, 1968)\(^{2,3}\) gave esthetic (E) line and descriptions were made for lip balance and facial harmony in adults and children using this line and was observed that most orthodontists termed a case 'disharmonious' or 'imbalance' when lips extended forward of this line.

Burstone C.J. (1958, 1967)\(^{4,5}\) studied lip posture and its significance in treatment planning, also developed a method of measuring the integumental profile.

Holdaway (1983-1984)\(^{6,7}\) described the soft tissue profile analysis utilizing the 'H line'.

Arnett G.W. and Bergman R.T. (1993)\(^{8,9}\) presented the facial keys to orthodontic diagnosis and treatment planning (Part I and II) as an organized, comprehensive 3-D clinical blue print for soft tissue analysis and treatment planning.

Czarnecki S.T., Nanda R.S., and Currier G.F. (1993)\(^{10}\) did a research to assess the role of nose, lips, and chin in achieving a balanced facial profile. The data was computed, and it was found that in males, a straighter profile was preferred in comparison with a slightly convex profile for the females.

Skinazi, Lindauer and Isaacson (1994)\(^{11}\) did a study on Chin, nose, and lips: Normal ratios in young men and women and found that the mean female profile was more convex and the mean male profile was relatively straighter.

Arnett, Jelic, Kin, Cummings and Bergman (1999)\(^{12}\) introduced a technique for Soft Tissue Cephalometric Analysis (STCA). With the STCA five different but interrelated areas can be diagnosed. They were:

- Dentoskeletal factors
- Soft tissue components
- Facial lengths
- True Vertical Line projections and
- Harmony of parts.

With the above in mind Robert T. Bergman\(^{13}\) in the year 1999 published Cephalometric soft tissue facial analysis in which eighteen soft tissue traits were discussed, which were independent of skeletal landmarks for measurement. This analysis when used along with the clinical facial analysis and cephalometric treatment planning can really help the orthodontist in recognizing the facial disharmonies and treating the patient according to the patient's esthetic preferences and not just the bite correction alone.

The preservation and enhancement of the patient's facial appearance is one of the primary objectives of an Orthodontist. Planning an improvement requires guidelines, or some kind of generally agreed 'ideal' set of facial proportions. The applicability of the norms suggested by Bergman (the study was done on Caucasian population) to the Indian population and specifically local Lucknow population has not been adequately researched.

The large size of our country accommodates a multitude of regional, ethnic and physical variations, leading to subtle and often significant differences in esthetic perception. The Indian Orthodontist, to meet the demands of esthetics apart from good dentition and the occlusal goals, needs values that are appropriate for the local population. To furnish the above for Lucknow population, we undertook the present study entitled "CEPHALOMETRIC SOFT TISSUE ANALYSIS OF INDIVIDUALS WITH PLEASANT FACES".

The aims and objectives of the study were:

1. To establish an organized and comprehensive approach to soft tissue facial analyses based on facial attractiveness in Lucknow population
2. To correlate the applicability of the norms established by Bergman's study to those established by ours & to establish statistically the difference between the male and female normal values in Lucknow population
3. To emphasize the role of population and region specific cephalometric soft tissue analysis in order to delineate optimal treatment guidelines.

**MATERIALS AND METHODS**

This study was conducted on a sample size of 100 subjects (50 males and 50 females) of 18 - 26 years age group with reasonably pleasing faces. Facial photographs of the subjects, both frontal & profile views were taken (Figs. 1, 2, 3, 4) and were given to a panel of judges from the related professions for evaluation.

30 males and 30 females were selected & formed the cephalometric database. The Lateral Cephalograms of the 60 selected individuals were taken in Natural Head Posture with seated condyles and relaxed lip position.

Standard tracing of the soft tissue profile as well as related osseous and dental structures were made on the Lateral Cephalograms, which were then subjected to soft tissue facial analysis as described by Bergman. Mean
values with standard deviations were calculated statistically and Student 't' test was applied to correlate and compare the soft tissue values of samples and to find out the significance of difference in their mean values. 'p' value was used to check the significance of mean values.

RESULTS:

1. Facial Profile angle (Fig. 5): In the present study, the mean value was 161.2° (S.D. = 5.16°) for males and 166° (SD = 4.255°) for females. The mean value was statistically higher in females as compared to males. The values of facial profile angle from our study for males were slightly less and for females were in close proximity with the reference range of 165°-173° (Bergman's study).
2. Nasal projection (Fig. 6): In the study conducted, the mean value was 15.68 mm (SD = 1.87 mm) for males and 14.8 mm (SD = 1.914 mm) for females. There was no statistically significant difference between male and female variables. The values of Nasal projection from our study were in close proximity with the reference range of 13 mm – 18 mm (Bergman's study).

3. Naso-labial angle (Fig. 6, 7): The mean value of Naso-labial angle was 105.35° (SD = 7.83°) for males and 103.58° (SD = 7.27°) for females. There was no statistically significant difference between male and female variables. The values of Naso-labial angle from our study were in close proximity with the reference range of 94°-110° (Bergman's study).

4. Lower Face % (Fig. 5): The mean value of LF% was 49.101% (SD = 1.87%) for males and 47.94% (SD = 2.354%) for females. There was no statistically significant difference between male and female variables. The values of Lower Face % from our study were less than the reference range of 53 -56% (Bergman's study).

5. Lower Facial Height (Fig. 5): The present study shows that the mean value was 70.957 mm (SD = 3.450 mm) for males and 66.783 mm (SD = 3.629 mm) for females. The mean value was statistically higher in males as compared to females. The values of Lower Facial Height from our study were in close proximity but on the higher side with the reference range of 57-74 mm (Bergman's study).

6. Upper Lip Length (Fig. 5): Present study shows that the mean value was 23.05 mm (SD = 2.191 mm) for males and 21.683 mm (SD = 2.086 mm) for females. The mean value was statistically higher in males as compared to females. The values of Upper Lip Length from our study were in close proximity with the reference range of 22 mm – 25 mm for males and 18 mm – 22mm for females (Bergman's study).

7. Upper Lip Thickness (Fig. 8): Our study shows that the mean value was 17.2 mm (SD = 1.755 mm) for males and 14.22 mm (SD = 1.723 mm) for females. The mean value was statistically higher in males as compared to females. The values of Upper Lip Thickness from our study were higher than the reference range of 10 mm – 14 mm (Bergman's study).
8. Maxillary Sulcus (Fig. 8): Our study shows that the mean value was 131.58° (SD = 10.80°) for males and 132.25° (SD = 10.839°) for females. There was no statistically significant difference between male and female variables. The values of Maxillary Sulcus from our study were in close proximity but on the lower side when compared to the reference range of 127°-147° (Bergman's study).

9. Upper Lip Protrusion (Fig. 9): In the present study it shows that the mean value was 4.117 mm (SD = 1.606 mm) for males and 3.750 mm (SD = 1.467 mm) for females. There was no statistically significant difference between male and female variables. The mean value for males in our study was higher but the mean value for females in our study was comparable to the reference value of 3 mm ± 1 mm (Bergman's study).

10. Upper Incisor Exposure (Fig. 6): Our study shows that the mean value was 2.717 mm (SD = 1.765 mm) for males and 3.067 mm (SD = 1.472 mm) for females. There was no statistically significant difference between male and female variables. The values of Upper Incisor Exposure from our study were in close proximity when compared to the reference range of 1 mm – 5 mm (Bergman's study).

11. Inter-labial Gap (Fig. 5): The results from our studies show that the mean value was 0.6 mm (SD = 0.635 mm) for males and 0.3 mm (SD = 0.447 mm) for females. The mean value was statistically higher in males as compared to females. The values of Inter-labial Gap from our study were less compared to the reference range of 1 mm – 5 mm (Bergman's study).

12. Lower Lip-Chin Length (Fig. 5): The study conducted by us shows that the mean value was 47.317 mm (SD = 2.683 mm) for males and 44.65 mm (SD = 2.386 mm) for females. The mean value was statistically higher in males as compared to females. The mean values in our study were comparable but slightly on the lower side when compared to the reference range of 45 mm – 54 mm for males and 43 mm – 50 mm for females (Bergman's study).

13. Lower Lip Thickness (Fig. 8): The study conducted shows that the mean value was 15.433 mm (SD = 1.883 mm) for males and 13.450 mm (SD = 1.522 mm) for females. The mean value was statistically higher in males as compared to females. The mean values in our study were comparable to the reference range of 11 mm – 15 mm (Bergman's study).

14. Mandibular Sulcus (Fig. 8): Our study shows that the mean value was 110.2° (SD = 11.26°) for males and 118.07° (SD = 8.30°) for females. The mean value was statistically higher in females as compared to males. The values of Mandibular Sulcus from our study were in close proximity but slightly on the lower side when compared to the reference range of 110°-134° (Bergman's study).

15. Lower Lip Protrusion (Fig. 9): Our study shows that the mean value was 2.133 mm (SD = 2.327 mm) for males and 2.35 mm (SD = 2.068 mm) for females. There was no statistically significant difference between male and female variables. The mean value of Lower Lip Protrusion from our study was in close proximity but slightly on the higher side when compared to the reference range of 2 mm ± 1 mm (Bergman's study).

16. Soft Tissue B Point–Subnasale Soft Tissue Pogonion (Fig. 9): The present study shows that the mean value was 5.770 mm (SD = 2.365 mm) for males and 3.950 mm (SD = 0.977 mm) for females. The mean value was statistically higher in males as compared to females. The mean value of soft tissue B point–subnasale soft tissue pogonion was in close proximity with the reference value of 4 mm ± 1 mm (Bergman's study).

17. Lower Face–Throat Angle (Fig. 5): Our study shows that the mean value was 115.417° (SD = 8.457°) for males and 102.167° (SD = 9.415°) for females. The mean value was statistically higher in males as compared to females. The mean value of Lower Face–Throat Angle for males was higher and for females was comparable with the reference range of 96°–110° (Bergman's study).

18. Throat Length (Fig. 5): Present study shows that the mean value was 57.883 mm (SD = 4.891 mm) for
males and 55.917 mm (SD = 4.503 mm) for females. There was no statistically significant difference between male and female variables. The values of Throat Length were comparable with the reference range of 51 mm – 63 mm (Bergman's study).

GRAPHS AND TABLES

1. Linear values for Male and Female subjects are represented in Graphs 1–3.
2. Angular values for Male and Female subjects are represented in Graphs 4–6.
3. Descriptive data (summarized in Graphs 1-6) were subjected to statistical analyses, the results of which are given in Tables I–III.

Graph – 1: Linear values in mm for Male subjects

Graph – 2: Linear values in mm for Female subjects
Graph – 3: Comparison of Linear values in mm between Male and Female subjects

Graph – 4: Angular values in degree for Male subjects
Graph – 5: Angular values in degree for Female subjects

Graph – 6: Comparison of Angular values in degree between Male and Female subjects
<table>
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<th>Parameter</th>
<th>Mean</th>
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<th>Max</th>
<th>Ref. Range</th>
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Table I: Showing mean, standard deviation, minimum and maximum values of various linear and angular soft tissue cephalometric measurements for Males subjects (n=30)

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<th>Parameter</th>
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Table II: Showing mean, standard deviation, minimum and maximum values of various linear and angular soft tissue cephalometric measurements for Female subjects (n=30)
### Table III: Showing comparison of mean values of Male subjects and Female subjects. ‘t’ and ‘p’ values of various linear and angular soft tissue cephalometric measurements

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<td>Mean±SD</td>
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<td></td>
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<tr>
<td>Lower Face-Throat Angle</td>
<td>115.42 ±8.46</td>
<td>102.17 ±9.42</td>
<td>5.735</td>
<td>0.000</td>
</tr>
<tr>
<td>Throat Length</td>
<td>57.88 ±4.89</td>
<td>55.92 ±4.50</td>
<td>1.620</td>
<td>0.111</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Extensive studies and measurements of facial features have resulted in various norms that orthodontists can use to evaluate the soft tissue form and relationships and to guide their therapy. A standard may very well represent the average or normal facial pattern and not necessarily be the best or most beautiful in the eyes of a given population.

The significant findings of our study are as follows:

Facial Profile angle (Fig. 5): In the present study, the mean value was statistically higher in females as compared to males. The values of facial profile angle from our study for males were slightly less and for females in close proximity with the reference range of 165°-173° (Bergman's study).

Results from our study demonstrate that our values were slightly less than those given by Burstone C.J.5 (168°±4.1°), Legan H.L. and Burstone C.J.13 (168°±4°) whose study was done on Caucasian population. However, our values for females were comparable with the values given by Czarnecki, Nanda and Currier9 (168°±3.5° for males and 165°±4.5° for females) in Caucasian population and Hedeki loi etal14 (168.5°±2.9° for males and 166.8°±4.9° for females) in Japanese population. It is commonly accepted that a slight tendency towards class II facial profile is acceptable in our population, whereas in Caucasian population a slight tendency towards class III facial profile is considered agreeable. Our study reveals that female values of our sample agree with those stated in most studies on Caucasian subjects, whereas male profiles in our sample have been accepted as balanced and esthetic, even when their facial profile angle are slightly more convex than values quoted in similar studies.

Nasal projection (Fig. 6): Nasal projection is an indicator of maxillary anteroposterior position.

The values of Nasal projection from our study were in close proximity with the reference range of 13 mm – 18 mm (Bergman’s study). Our values were also comparable to the values given by Genecov J.5.15 (16±2 mm for males and 14.6±2.1 mm for females), Burstone16 (15.5±2.8 mm) and Holdaway's7 (range of
Nasal projection is 14 mm – 24 mm) in Caucasian population.

Naso-labial angle (Fig. 6, 7): This useful measurement indicates the protrusion of the upper lip relative to the nose, but can also be a reflection of the up or down tip of the nose.

The values of Naso-labial angle from our study were in close proximity with the reference range of 94°-110° (Bergman's study).

It is evident from the above that grey areas exist in our understanding of esthetics and normalcy. Often, both these terms disagree with each other. Our studies agree with values of studies done with esthetics appraisal in mind 12,15,17, rather than studies done to derive normal values. 13,18,19,20,21.

Lower Face % (Fig. 5): The values of Lower Face % from our study were less than the reference range of 53-56% (Bergman’s study). Our results go on to suggest that on a percentile basis, mildly shorter faces (particularly lower faces) as compared to studies on Caucasian population are esthetically acceptable in our society.

Lower Facial Height (Fig. 5): The present study shows a mean value of 70.957 mm (SD = 3.450 mm) in males and 66.783 mm (SD = 3.629 mm) in females. The mean value was statistically higher in males as compared to females. The range of Lower Facial Height from our study was in close proximity but on the higher side of the reference range from Bergman’s study (57-74 mm).

Our values were comparable to the values given by Farkas L.G. 3 (71.9±6 mm for males and 65.5±4.5 mm for females), Arnett 1 (60–68 mm) and Bolton 1 (70.2 mm).

The upper end of the reference range for males and females in our sample was comparable to the Bergman’s (74 mm), but the lower value was significantly higher than Bergman’s (57 mm) study, signifying that our esthetic acceptance of lower face height dramatically decreases with decrease in this parameter. We are possibly more critical about the influence of lower facial height in esthetics. A shorter lower facial height does not appeal to our senses and our values reflect this.

If both Lower Face% and Lower Face Height are considered simultaneously, our study shows that upper face height (soft tissue glabella to subnasale) in our population is comparatively more hence showing a decreased Lower Face % in spite of normal lower facial height.

Upper Lip Length (Fig. 5): A short upper lip can cause a “gummy” smile. Long lips make it difficult to see the maxillary incisors. Excessively long lip length will often be associated with lip redundancy.

The present study shows a mean value 23.05 mm (SD = 2.191 mm) for males and 21.683 mm (SD = 2.086 mm) for females. The mean value was statistically higher in males as compared to females. The values of Upper Lip Length from our study were in close proximity with the reference range of 22 mm – 25 mm for males and 18 mm – 22 mm for girls (Bergman’s study).

Esthetics and normalcy sometimes don’t walk hand in hand. The results from our study agreed to studies done with esthetics appraisal 12,13,16,22 in mind than studies done to derive normal values. 13,16,22.

Upper Lip Thickness (Fig. 8): Our study shows a mean value of 17.2 mm (SD = 1.755 mm) for males and 14.22 mm (SD = 1.723 mm) for females. The mean value was statistically higher in males as compared to females. The values of Upper Lip Thickness from our study were higher than the reference range of 10 mm – 14 mm (Bergman’s study).

Our values were also higher than the values given by Formby, Nanda and Currier 20 (14.73 mm for males and 12.96 mm for females), by Holdaway R.A. 7 (13-14 mm), and by Mrandras A.H.22 (15.76±1.58 mm for males and 12.50±1.58 mm for females). However, our values were less than the values given by Genecov I.S. 15 (19.99±2.7 mm for males and 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 (The comparative studies were all done in Caucasian samples).

Maxillary Sulcus (Fig. 8): It a gentle curve and gives information regarding upper lip tension.

The mean value for males in our study was 131.58° (SD = 10.80°) and it was 132.25° (S.D = 10.839°) for females. The values of Maxillary Sulcus from our study were in close proximity but on the lower side when compared to the reference range of 127°–147° (Bergman's study). Our values were also less compared to the values given by Burstone5 (136.9° ± 10°). However, our values were more than those given by Bolton3 (122.7°). The approximation of values from our study suggests that angulation of Maxillary sulcus in our population is less compared to Caucasian population, signifying a thicker upper lip and its esthetic acceptance in our sample.
Upper Lip Protrusion (Fig. 9): The present study shows a mean value of 4.117 mm (SD = 1.606 mm) for males and 3.750 mm (SD = 1.467 mm) for females. The mean value for males in our study was higher, for females in our study it was comparable to the reference value of 3 ± 1 mm (Bergman's study).

As the comparison demonstrates, study indicates that a more greater Upper Lip Protrusion is esthetically more acceptable in the population of our study group as compared to studies on Caucasian samples. However, comparison of the same with studies on Japanese subjects shows that the opposite is true.

Upper Incisor Exposure (Fig. 6): Our study shows a mean value of 2.717 mm (SD = 1.765 mm) for males and 3.067 mm (SD = 1.472 mm) for females. The values of Upper Incisor Exposure from our study were in close proximity when compared to the reference range of 1 mm - 5 mm (Bergman's study). Burstone C.J. (2 ± 2 mm) and by Arnett (1 mm - 5 mm, higher in females than males), our value for males was higher and value for females was comparable to the values given by McCollum T.G. (1 mm - 2 mm for males and 3 mm - 5 mm for females). However, our values were less compared to Peck and Kateja (5.3 mm ± 1.8 mm for males and 4.7 mm ± 2 mm for females). In our study, it is found that in Lucknow population, the Upper Incisor Exposure values corroborate with that of Caucasian population. It is also found that in females greater upper incisor exposure is considered more acceptable than in males, which concur with the various studies.

Inter-labial Gap (Fig. 5): The results of our study shows a mean value of 0.6 mm (SD = 0.635 mm) for males and 0.3 mm (SD = 0.447 mm) for females. The mean value was statistically higher in males as compared to females. The values of Inter-labial Gap from our study were less compared to the reference range of 1 mm - 5 mm (Bergman's study).

Our study indicates none to a very little Inter-labial gap is esthetically acceptable in our population, whereas studies by different workers show that interlabial gap or lip in-competency up to 6 mm is agreeable in Caucasian population. Females in our sample show greater Inter Labial gap than males, reinforcing the acceptability of this parameter as well as increased Maxillary Incisor Exposure.

Lower Lip–Chin Length (Fig. 5): We observed a mean value of 47.317 mm (SD = 2.683 mm) for males and 44.65 mm (SD = 2.386 mm) for females. The mean value was statistically higher in males as compared to females. The mean values in our study were in close proximity but slightly on lower side when compared to the reference range of 45 mm - 54 mm for males and 43 mm - 50 mm for females (Bergman's study). Our study demonstrate that our values were less when compared to the values given by Burstone (49.9 ± 4.5 mm for males and 46.4 ± 3.4 mm for females), Genevoc J.C. (55.2 ± 5.7 mm for males and 51.9 ± 3.4 mm for females), Zylinski, Nanda and Kapilla (57.5 ± 3 mm). However, our values were more when compared to the values given by Mamandras A.H. (44.72 ± 2.84 mm for males and 40.15 ± 3.72 mm for females) and by Arnett (38 mm – 44 mm).

Lower Lip Thickness (Fig. 8): The study conducted shows that mean value for males was 15.433 mm (SD = 1.883 mm) and it was 13.450 mm (SD = 1.522 mm) for females. The mean value was statistically higher in males as compared to females. The mean values in our study were comparable to the reference range of 11 mm - 15 mm (Bergman's study). Our values were also comparable to Formby, Nanda and Currier (14.64 mm for males and 13.24 mm for females).

Results from our study demonstrate that our values were less when compared to the values given by Genevoc J.C. (17.0 ± 2.1 mm for males and 16.2 ± 1.6 mm for females). However, our values were higher than compared to Mamandras A.H. (12.0 ± 1.51 mm for males and 10.98 ± 1.65 mm for females).

Mandibular Sulcus (Fig. 8): It is a gentle curve and indicate lip tension.

The present study shows that the mean value was 110.2° (SD = 11.26°) for males and 118.07° (SD = 8.30°) for females. The mean value was statistically higher in females as compared to males. The values of Maxillary Sulcus from our study were in close proximity but slightly on the lower side when compared to the reference range of 110°-134° (Bergman's study).

Results from our study demonstrate that our values were less compared to the values given by Burstone (122 ± 11.7°), Zylinski, Nanda and Kapila (124.3 ± 13.1°), Hideki loi et al (129.6 ± 13.7° for males and 140.5 ± 13.8° for females) for Japanese population and Formby, Nanda and Currier (125.75° for males and 123.65° for females).

In comparison to most studies, it was found that a mildly reduced mandibular sulcus contour in our population is acceptable.

Lower Lip Protrusion (Fig. 9): The present study shows
that the mean value was 2.133 mm (SD = 2.327 mm) for males and it was 2.35 mm (SD = 2.068 mm) for females. The mean values of Lower Lip Protrusion from our study were in close proximity but slightly on the higher side when compared to the reference range of 2 mm ± 1 mm (Bergman's study).

The values from our study confirm the fact that the ethnic and racial variation plays an important role in esthetic evaluation. Data from other studies indicate that Caucasians have the least Lower Lip Protrusion followed by our population and then the Japanese population having the highest Lower Lip Protrusion. Thus, this parameter also, reinforces the importance of customized normal values for indigenous populations.

The present study also highlights the fact that for our sample although greater sulcus contour was acceptable, esthetic acceptability reduced with increase in Lower Lip Projection.

Soft Tissue B Point—Subnasale Soft Tissue Pogonion (Fig. 9): The present study shows that the mean value was 5.770 mm (SD = 2.365 mm) for males and it was 3.950 mm (SD = 0.977 mm) for females. The mean value was statistically higher in males as compared to females. The mean values of soft tissue B point—subnasale soft tissue pogonion were in close proximity with the reference value of 4 ± 1 mm (Bergman's study). Results from our study demonstrate that our values were comparable to the values given by Bolton (5.3 mm). However, values were more than values of Arnett (4 mm).

The study done by us, found that in Lucknow population the soft tissue B point—subnasale soft tissue pogonion was comparable with the Caucasian population endorsing the fact that slightly increased mandibular sulcus contour/depth is esthetically acceptable in our population sample.

Lower Face—Throat Angle (Fig. 9): Our study shows that the mean value was 115.417° (SD = 8.457°) for males and it was 102.167° (SD = 9.415°) for females. The mean value was statistically higher in males as compared to females. The mean value of Lower Face—Throat Angle for males was higher and for females was comparable with the reference range of 96°—110° (Bergman's study).

The present study shows that in our sample the soft tissue Lower Face—Throat Angle in males was significantly higher compared to females demonstrating the following probabilities:

Ø Esthetic acceptance of a less prominent chin in males in Lucknow population.

Ø Mild increase in the amount of submental fat in males (leads to increase in this angle), not affecting the esthetic outlook negatively in males.

The results of our study with regard to facial profile angle demonstrated increased convexity as esthetically acceptable in males. One of the factors which influence this increase is mandibular length, which also affects the Lower face throat angle. The mutual agreeability of these parameters strengthens the view that a mild class II skeletal tendency is acceptable in our population, particularly in males.

Throat Length (Fig. 9): Present study shows that the mean value was 57.883 mm (SD = 4.891 mm) for males and it was 55.917 mm (SD = 4.503 mm). The mean values of Throat Length were comparable with the reference range of 51 mm—63 mm (Bergman's study).

The present study suggests that Throat Length in our local Lucknow population was comparable with the Caucasian population.

CLINICAL IMPLICATIONS

The conclusions drawn from our study are not independent but are in comparison with the findings of the reference study by Bergman, whose methodology we adopted.

The following we feel are the most significant and clinically relevant findings of our study:

1. A mild convexity of the face and resulting tendency towards Class II in males is acceptable esthetically in our population

2. Straighter profiles are preferred for females in our population

3. Decreased Lower Face % and a mild increase in upper face height (G - Sn) are considered balanced and esthetic

4. A fuller upper lip, with a slight protrusion is considered balanced and esthetic

5. Increase in lip in-competency is considered unaesthetic in our population

The other variables of the soft tissue showed a similar trend as that of Caucasian population.

The present study re-emphasizes the spectra of variations the soft tissue covering of the face is capable of and also draws attention to the areas of ethnic and racial variation.

LIMITATIONS

1. This study was conducted on a sample size of 100 subjects (50 males and 50 females) of 18 - 26 years
age group. Although, we used a larger sample than our reference study12 and some other studies14,20,22,23 done in this regard, we feel that a larger sample size would have been more appropriate to assert the findings with greater confidence. Future studies would do well to increase the sample size. This becomes particularly important considering our large population with its innumerable variations.

2. The homogeneity of our sample may have been compromised to some extent due to random selection of subjects from the various parts of Lucknow. Future studies can improve homogeneity by dividing the city into grids and selecting equal number of subjects from each one. Our intention was to conduct a pilot study which would pave the way for more intensive research in this direction.

REFERENCES