Original Article

Analysis of the Soft-tissue Facial Profile – In Madhya Pradesh Population

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Abstract

Aim of the Study: The aim of the present study was to evaluate the average variables that define the soft-tissue facial profile of a Madhya Pradesh sample by means of angular measurements. **Objectives of the Study:** The aims of this study were as follows: (1) To analyze the soft-tissue facial profile by means of angular measurements on photographs. (2) To compare differences in facial angular measurements in males and females of Madhya Pradesh. **Materials and Methods:** The study was conducted among 110 individuals out of which 50 were males and 60 were females aging between 18 and 25 years having Angle's Class I occlusion with normal overjet overbite, growth and development, pleasing and balanced profile, and maxillary and mandibular arches with mild discrepancies with all the teeth present excluding third molars. In the present study, individuals belonging to Madhya Pradesh were included in the study. **Results:** The comparison between males and females was done with the help of the unpaired Student's t-test. The level of significance was fixed at $P = 0.05$ and any value <0.05 was considered as statistically significant. Gender differences were seen in nasolabial, mentolabial angle, nasomental angle, projection of upper lip to chin angle, and projection of lower lip to chin angle. **Conclusion:** The mean values that we derived in our study can be considered as normal values for the Madhya Pradesh population. It can be used as a very good guide for the comparison of subjects with malocclusion. Further studies are required in this area.

Keywords: Angular measurements, Facial profile, Photograph, Soft-tissue.

Introduction

A person's ability to recognize a beautiful face is innate but translating this into defined treatment goals is problematic. Recognizing beauty is not practiced nor is it difficult. The perception of beauty is an individual preference with cultural bias.[1] The face plays a key role in communication and interaction with the environment. This part of the body has been extensively studied by scientists, clinicians, artists, and many who have tried to measure and reproduce some of the facial characteristics.[2] Many authors have suggested utilizing soft-tissue analysis as a reliable guide for occlusal treatment and attendant soft-tissue changes. Arnett *et al*. presented the facial keys to orthodontic diagnosis and treatment planning as a three-dimensional clinical blueprint for soft-tissue analysis and treatment planning.[3] Radiographic cephalometrics and photographic systems are the most suitable and commonly used for facial soft-tissue evaluation.

The photographic systems do not expose the patient to potentially harmful radiation and can provide a better evaluation of the harmonic relationships. Nowadays, with more and more emphasis from the orthodontic community on the achievement of balanced facial harmony and smile esthetics for the patients, in addition to the traditional orthodontic treatment objectives of a proper alignment and functional dentition, clinical photographic record of the patient has become more obvious and essential for good treatment planning and follow-up.[4] Conventionally, in orthodontic diagnosis and treatment planning, consideration was given to occlusion and hard tissue relationships only; however, in modern orthodontics, soft-tissue assessment is given its due share.

Facial appearance is subjective with age, gender, culture, and ethnicity. Various studies conducted on the adaptation of soft tissues to the underlying skeleton holds significance and vary from one ethnic group to other. At present, there are various parameters for soft-tissue analysis that offer orthodontist an important tool to determine facial esthetics.[5] Graber stated

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that the photograph assumes even greater importance when dentists do not have equipment for taking cephalograms; he considers facial photographs an essential diagnostic tool. From the lateral view, facial height, facial depth, mandibular angle, and the positions of the upper and lower lips are the main factors that characterize facial patterns.[6] Today multicultural society, racial, and ethnic differences are assuming an increasing level of importance. Metropolitan areas of the world have a much more diverse patient population indicating that a single standard of facial esthetics may not be appropriate when making diagnostic and treatment planning decisions for patients from diverse racial and ethnic backgrounds.[7] Many parameters of the soft-tissue cephalometric analysis can also be assessed on the patients' profile photograph. Thus, a photograph-based cephalometric analysis could be helpful for orthodontic treatment planning in those cases where the cephalometric radiograph is not specifically indicated.[8]

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 range can help to formulate a treatment plan designed to normalize facial traits for a given individual.[9] The photometric analysis is selected because it offers advantages in terms of human profile analysis. First, angular and linear measurements are not affected if the photograph is taken in 1:1 ratio that is life-size with standardization of photographic setup. Finally, photogrammetric profile analysis does not require expensive equipment and complex procedures, and it offers digitized results that are easily evaluated. Hence if there is a need for a low-cost, non-invasive method to be used in diverse clinical and field settings, the photographic method is better.[10]

In India, the population comprises different ethnic groups belonging to different races. They are included in the Caucasoid type of human race. The other two types are Mongoloid and Negroid. The Caucasoid type includes the Europeans, the white Americans, the Punjabis, and the Bengalis. Hence, it is an accepted fact that norms for different ethnic groups can differ widely. Therefore, it is not correct to apply the norms for the western population blindly to the Indian population. Hence there is a need to develop norms pertaining to Indian ethnic groups.[4] This study is done to set the standard norms of esthetic pleasing and balanced face in Madhya Pradesh population. The study of soft tissue and their normal range will help the orthodontist of M.P. to formulate, to normalize the facial traits of given individual.

Aim of the study

The aim of the present study was to evaluate the average variables that define the soft-tissue facial profile by means of angular measurements of a Madhya Pradesh population.

Objectives of the study

The objectives of the study are as follows:

1. To analyze the soft-tissue facial profile by means of angular measurements on photographs in the Madhya Pradesh population
2. To compare the differences in facial angular measurements in males and females of Madhya Pradesh.

Materials and Methods

Study design

The present study is conducted in the Department of Orthodontics and Dentofacial Orthopedics, RKDF Dental College and Research Centre, Bhopal, M.P. The sample comprised of 110 subjects the age group was 18–25 years for both males and females.

Inclusion criteria

The following criteria were included in the study:

1. All subjects exhibited a dental Class I occlusion showing a pleasing and balanced profile
2. All subjects with normal overjet–overbite relationships
3. Full permanent dentition (with the exception of the third molar)
4. Subjects with no previous orthodontic or surgical treatment
5. Minor crowding or spacing was acceptable.

Exclusion criteria

The following criteria were excluded from the study:

1. Mixed or Deciduous dentition
2. Missing molar
3. Cleft palate case.

The material used for the study was (1) Digital camera, (2) Tripod, (3) Millimeter Scale, (4) Wall-mounted mirror, (5) Computer, (6) Plumb line, (7) Extraoral right profile photograph, (8) Single Matte acetate sheets, (9) 3H drawing pencil/0.5-mm-diameter lead pencil, (10) Pencil leads, (11) Protractor, (12) Scale, (13) Eraser, and (14) Tape (Figure 1).

Methodology

The photographic set-up consisted of a tripod supporting a digital camera. Adjustment of the tripod height allowed the optical axis of the lens to be maintained in a horizontal position during the photography; this was adapted to each subject's body height. In a standing position, each subject was asked to relax with both arms free beside the trunk. The subject was positioned on a point marked on the floor, and there was placed a vertical measurement scale divided into millimeters that allowed measurements at life size. 120 cm in front of the subject, on the opposite wall, was a mirror. The subjects had to look into their eyes in the mirror with their lips relaxed so that the right-side profile records were taken in the natural head position. The same procedure was repeated for every subject. The camera-to-the-subject distance was maintained at a constant distance of 5 feet for all the subjects. Before every recording, the operator ensured that the subject's forehead, neck, and ear were clearly visible and their lips were in repose (Figure 2). The photographic records were analyzed and cropped to 4" width and 6" height (4 × 6) with the software Windows, Microsoft Office 2010 Proofing Tools. Computerized printout of all photographs was taken

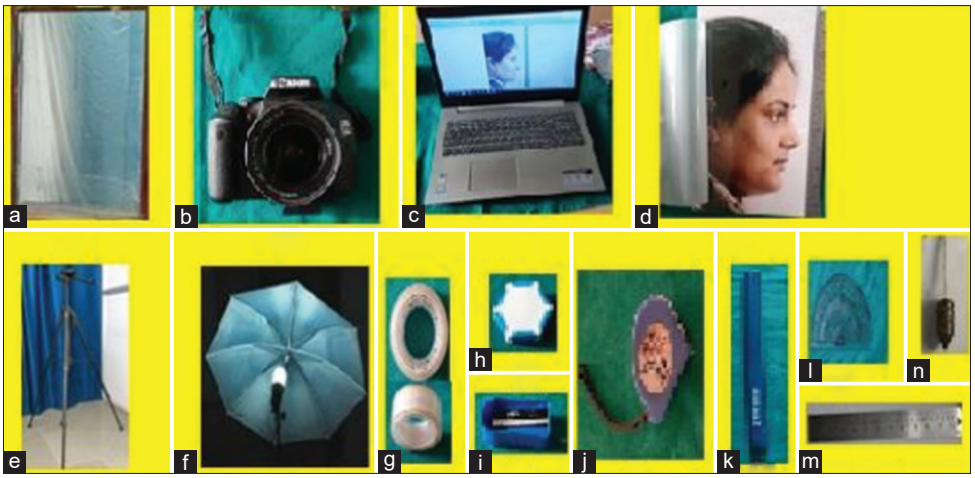

Figure 1: (a) Wall mounted mirror, (b) camera, (c) Computer, (d) Profile photo with tracing sheet, (e) Tripod stand, (f) Diffuser, (g) Tape, (h) Rubber, (i) Sharpner, (j) Measurement tape, (k) 3H Pencil, (l) Protractor, (m) Steel scale, and (n) Plumb line

Figure 2: Photographic set-up

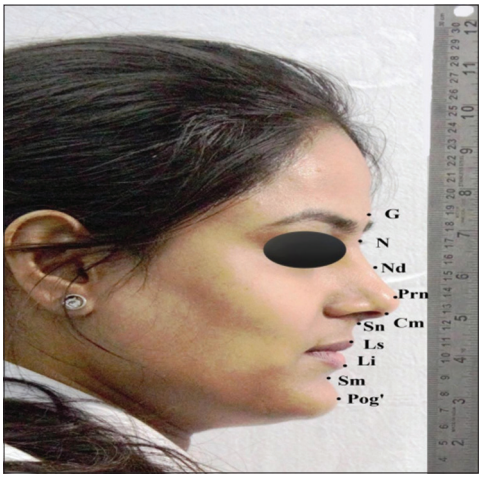

Figure 3: The landmarks used in the study: glabella (g), nasion (n), nasal dorsum (Nd), pronasale (Prn), columella (Cm), subnasale (Sn), labiale superior (Ls), labiale inferior (Li), supramentale (Sm), and pogonion (Pg)

out. Tracing was done using 0.003-inch acetate matte tracing paper and 3H hard lead pencil. Soft-tissue landmarks were marked and angular photogrammetric analysis was carried out (Figures 3-6).

Soft-tissue landmarks used in the study:

- G = Glabella. The most prominent anterior most point in the midsagittal plane of forehead.
- N' = Soft-tissue nasion. The point of greatest concavity in the midline between the forehead and the nose.
- Nd = Nasal dorsum. The border between the root and the tip of the nose.
- Pr = Pronasale. The most prominent or anterior part of the nose (tip of the nose).
- Cm = Columella. The midpoint between the base of the nose and nasal tip.
- Sn = Subnasale. The point at which the columella (nasal septum) merges with the upper line in the midsagittal plane.
- SLS = Superior labial sulcus. The point of greatest concavity in the midline of the upper lip between subnasale and labrale superius.
- Ls = Labrale superius. A point indicating the mucocutaneous border of the upper lip.The most anterior point of the upper lip.
- Li = Labraleinferius. The median point in the lower margin of the lower membranous lip.
- Sm = Supramental. The point of greatest concavity in the midline of the lower lip between labraleinferius and soft-tissue pognion. also known as Labiomental sulcus (SI).
- Pog' = Soft-tissue pogonion. The most prominent or anterior point on the chin in the midsagittal plane.

Results

The study was conducted to evaluate the average variables that define the soft-tissue facial profile of a Madhya Pradesh sample by means of angular measurements. Statistical procedures were carried out in two steps: (1) Data compilation and presentation, (2) Statistical analysis: Statistical analysis

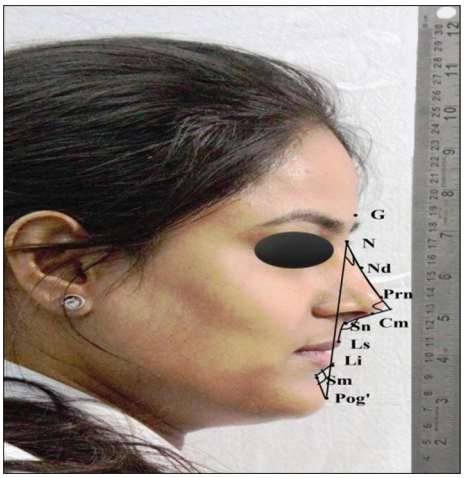

Figure 4: Angular measurements: nasomental angle (N-Prn/N-Pg); nose tip angle (N-Prn-Cm); nasolabial angle (Cm-Sn-Ls); mentolabial angle (Li-Sm-Pg). G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, Pg: Pogonion

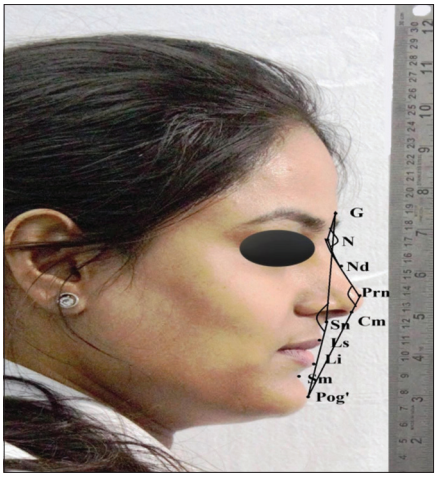

Figure 5: Angular measurements: nasofrontal angle (G-N-Nd); total facial angle or facial convexity including the nose (N-Prn-Pg); facial angle or angle of facial convexity excluding the nose (G-Sn-Pg). G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, and Pg: Pogonion

was done using Statistical Package for the Social Science (SPSS Version 22; Armonk, NY, USA). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. The comparison of the present data with the Caucasian population was done with the help of One Sample t-test. The comparison between males and females was done with the help of unpaired student t-test. The level of significance was fixed at $P = 0.05$ and any value <0.05 was considered as statistically significant. The angles measured included facial angle (G-Sn-Pg), total facial angle (NPrn-Pg), nasofrontal angle (G-N-Nd), nasolabial angle (Cm-Sn-Ls), mentolabial angle (Li-Sm-Pg), projection of upper lip to chin (N-Pg/N-Ls), projection of lower lip to

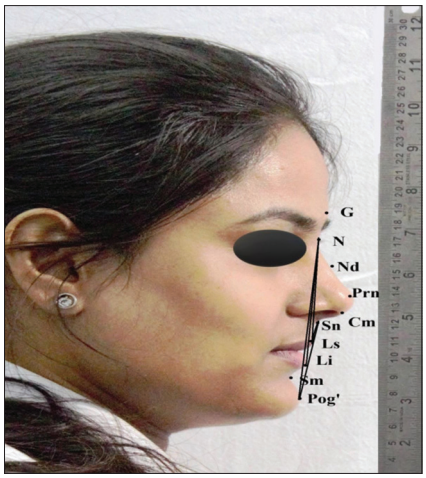

Figure 6: Angular measurements: Projection of the upper lip to chin (N-Pg/N-Ls); upper lip angle (Sn-Ls/Sn-Pg); projection of the lower lip to chin (N-Pg/N-Li). G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, and Pg: Pogonion

chin (N-Pg/N-Li), nose tip angle (N-Prn-Cm), nasomental angle (N-Prn/N-Pg) and upper lip angle (Sn-Ls/Sn-Pg). The average measurement values for the study population are shown in Table 1. The mean value for facial angle (G-Sn-Pg) was 170.84° ± 3.73°. The average measurement value for total facial angle (N-Prn-Pg) was 131.00° ± 3.41°. The average measurement value for nasofrontal angle (G-N-Nd) was 138.90° ± 6.22°. The average measurement value for nasolabial angle (Cm-Sn-Ls) was 98.65° ± 8.99°. The average measurement value for mentolabial angle (Li-Sm-Pg) was 123.04° ± 10.23°. The average measurement value for projection of lower lip to chin (N-Pg/NLs) was 8.85° ± 1.68°. The average measurement value for projection of lower lip to chin (N-Pg/NLi) was 4.39° ± 0.93°. The average measurement value for nose tip angle (N-Prn-Cm) was 77.90° ± 11.56°. The average measurement value for nasomental angle (N-Prn/N-Pg) was 28.99° ± 2.42°. The average measurement value for upper lip angle (Sn-Ls/Sn-Pg) was 16.45° ± 4.13° (Table 2). The mean value for angles in the study population and for Caucasian population shows a significant difference in angular measurement except for G-N-Nd angle (Table 3).

The mean value of G-Sn-Pg angle for male was 170.50° ± 3.93° and for female was 171.12° ± 3.57°. The result shows a non-significant difference between male and female with t = 0.86 and $P = 0.391$. The mean value of N-Prn-Pg angle for males was 130.51° ± 3.62° and for female was 131.42° ± 3.20°. The result shows a non-significant difference between male and female with t = 1.39 and $P = 0.166$. The mean value of G-N-Nd angle for male was 138.56° ± 7.62° and for female was 139.18° ± 4.2°. The result shows non-significant difference between male and female with t = 0.52 and $P = 0.603$. The mean value of Cm-Sn-Ls angle for male was 97.04° ± 7.54° and for female was 99.98° ± 9.91°. The result shows significant difference between male and female with t = 1.98 and

Table 1: Characteristic values of various parameters in the study population

Parameters	*n*	Minimum	Maximum	Mean	Standard deviation
G-Sn-Pg	110	160	179	170.84	3.73
N-Prn-Pg	110	122	138	131	3.41
G-N-Nd	110	124	155	138.90	6.22
Cm-Sn-Ls	110	78	120	98.65	8.99
Li-Sm-Pg	110	104	142	123.04	10.23
N-Pg/N-Ls	110	6	14	8.85	1.68
N-Pg/N-Li	110	3	6	4.39	0.93
N-Prn-Cm	110	8	92	77.90	11.56
N-Prn/N-Pg	110	24	35	28.99	2.42
Sn-Ls/Sn-Pg	110	9	27	16.45	4.13

G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, Pg: Pogonion

Table 2: Comparison between the study population and Caucasian Population

Parameters	*n*	Mean	Standard deviation	Caucasian	*P*-value
G-Sn-Pg	110	170.84	3.73	168.92	0.001*
N-Prn-Pg	110	131	3.41	130.32	0.038*
G-N-Nd	110	138.90	6.22	137.82	0.07
Cm-Sn-Ls	110	98.65	8.99	107.51	0.001*
Li-Sm-Pg	110	123.04	10.23	132.02	0.001*
N-Pg/N-Ls	110	8.85	1.68	7.08	0.001*
N-Pg/N-Li	110	4.39	0.93	3.49	0.001*
N-Prn-Cm	110	77.90	11.56	82.10	0.001*
N-Prn/N-Pg	110	28.99	2.42	29.97	0.001*
Sn-Ls/Sn-Pg	110	16.45	4.13	12.33	0.001*

G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, Pg: Pogonion

Table 3: Comparison of parameters between genders in study population

Parameter	Gender	*n*	Mean	Standard deviation	T-value	*P*-value
G-Sn-Pg	Male	50	170.50	3.93	0.86	0.391
	Female	60	171.12	3.57		
N-Prn-Pg	Male	50	130.51	3.62	1.39	0.166
	Female	60	131.42	3.20		
G-N-Nd	Male	50	138.56	7.62	0.52	0.603
	Female	60	139.18	4.82		
Cm-Sn-Ls	Male	50	97.04	7.54	1.98	0.049*
	Female	60	99.98	9.91		
Li-Sm-Pg	Male	50	121.10	10.38	1.99	0.048*
	Female	60	124.65	9.92		
N-Pg/N-Ls	Male	50	9.20	1.76	2.09	0.043*
	Female	60	8.57	1.58		
N-Pg/N-Li	Male	50	4.46	0.89	0.70	0.484
	Female	60	4.33	0.98		
N-Prn-Cm	Male	50	76.96	5.99	-0.83	0.409
	Female	60	78.68	14.70		
N-Prn/N-Pg	Male	50	29.96	2.17	4.09	0.000*
	Female	60	28.18	2.35		
Sn-Ls/Sn-Pg	Male	50	16.62	4.36	0.38	0.703
	Female	60	16.32	3.96		

G: Glabella, N: Nasion, Nd: Nasal dorsum, Prn: Pronasale, Cm: Columella, Sn: Subnasale, Ls: Labiale superior, Li: Labiale inferior, Sm: Supramentale, Pg: Pogonion

$P = 0.049$. The mean value of Li-Sm-Pg angle for male was 121.10° ± 10.38° and for female was 124.65° ± 9.92°. The result shows a significant difference between male and female with t = 1.99 and $P = 0.048$. The mean value of N-Pg/N-Ls angle for male was 9.20° ± 1.76° and for female was 8.57° ± 1.58°. The result shows a significant difference between male and female with t = 2.09 and $P = 0.043$. The mean value of N-Pg/N-Li angle for male was 4.46° ± 0.89° and for female was 4.33° ± 0.98°. The result shows significant difference between male and female with t = 0.70 and $P = 0.48$. The mean value of N-Prn-Cm angle for male was 76.96° ± 5.99° and for female was 78.68° ± 14.70°. The result shows a non-significant difference between male and female with t = 0.83 and $P = 0.409$. The mean value of N-Prn/N-Pg angle for male was 29.96° ± 2.17° and for female was 28.18° ± 2.35°. The result shows significant difference between male and female with t = 4.09 and $P = 0.001$. The mean value of Sn-Ls/Sn-Pg angle for male was 16.62° ± 4.36° and for female was 16.32° ± 3.96°. The result shows a non-significant difference between male and female with t = 0.38 and $P = 0.703$ (Table 3).

Discussion

Preservation and improvement of facial attractiveness is a primary goal of orthodontic treatment. Treatment planning requires knowledge of the parameters and normative data that help to establish goals and predict the obstacles that need to be negotiated.[11] As we know the norms attained by various analyses are based on foreign samples. 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.

Indian population is polygenetic and an amalgamation of various races and cultures. Hence, the established norms for other ethnic group are difficult to apply on Indian population.[11] Traditionally orthodontists have used lines and angles for evaluation of the soft-tissue profile derived from Caucasian samples and very little information has been available for other races. The study was conducted to evaluate the average variables that define the soft-tissue facial profile of a Madhya Pradesh sample by means of angular measurements. The sample comprised of 110 subjects with Class I occlusion with mild discrepancy. The age group was 18–25 years and includes both males and female participants. The participants had a pleasing and balanced profile and without previous orthodontic or surgical intervention. The angles measured included facial angle (GSn-Pg), total facial angle (N-Prn-Pg), nasofrontal angle (G-N-Nd), nasolabial angle (Cm-Sn-Ls), mentolabial angle (Li-Sm-Pg), projection of upper lip to chin (NPg/N-Ls), projection of lower lip to chin (N-Pg/N-Li), nose tip angle (N-Prn-Cm), nasomental angle (N-Prn/N-Pg) and upper lip angle (Sn-Ls/Sn-Pg). In the present study, the value for the facial angle (G-Sn-Pg) for Madhya Pradesh males was 170.50 ± 3.93° and females was 171.12 ± 3.57° which showed that there was a statistically non-significant gender difference in Madhya Pradesh population.

This result of our study was in accordance with the previous studies by Fernández-Riveiro *et al*., Anić-Milosević *et al*., Malkoc *et al*. and Arnett and Bergman, Raj *et al*. which also showed no significant gender difference. However, according to the study conducted by Devi *et al*., the value for the facial angle (G–Sn–Pg°) for Bengali males (165.1 ± 3.3°) and females (168.1 ± 4.1°) showed a statistically significant gender difference ($P = 0.0001$). In our study, the total facial angle (N-Prn-Pg) for males was 130.51° ± 3.62° and females was 131.42° ± 3.20°. The result shows a non-significant difference between male and female with t = 1.39 and $P = 0.166$. Fernández-Riveiro *et al*.[12] (males = 139.9°; females = 139.2°), Anić-Milosević *et al*.[13] (males = 130.47°; females = 130.19°) and Malkoc *et al*.[14] (males = 142.35°; females = 142.57°), and Raj *et al*.[10] (males = 129.52°; females = 130.86°) also found no significant gender difference. Whereas in the study conducted by Devi *et al*.[4] total facial angle (N-Prn-Pg) for males (128.50°) and females (130.55°) showed statistically significant gender difference ($P = 0.0012$). In our study, the nasofrontal angle (G-N-Nd) was 138.56° ± 7.62° for males and 139.18° ± 4.2° for females with no statistical significant gender difference. However, Fernández-Riveiro *et al*.[12] found gender difference (males = 138.57°; females = 141.98°). Anić-Milosević *et al*.[13] also found gender difference (Caucasian males = 136.38°; females = 139.11°). Malkoc *et al*.[14] Devi *et al*.[4] Raj *et al*.[10] found no significant gender difference supporting the present study. The Nasolabial angle can be altered by orthodontic or surgical treatment and depends on the anteroposterior position or inclination of the upper anterior teeth. According to Bergman,[15] this angle should be 102 ± 8° for orthodontic or surgical correction. This is useful for assessing the upper lip position and to decide whether extraction to be done or not. In the study of Talass *et al*.[16] premolars were extracted in class II malocclusion subjects, the upper incisors were retracted 6.7 mm on average and the angle increased on average 10.5° with orthodontic treatment (1.6° for each millimeter of incisor retraction). In the present study, the nasolabial angle (Cm-Sn-Ls for males = 97.04° ± 7.54°; females = 99.98° ± 9.91°) showed statistically significant gender difference in agreement with the findings of the previous study by Anić-Milosević *et al*.[13] They found the nasolabial angle as the most significant angular variable between the genders. Malkoc *et al*.[14] also found this angle with large variations between males and females. This should be interpreted with caution. Burstone[17] reported a nasolabial angle of 74 ± 8° in a Caucasian adolescent sample with a normal facial appearance. Fernández-Riveiro *et al*.,[12] found no gender difference. According to the studies conducted by Devi *et al*.[4] statistically significant gender difference was found in the Bengali population whereas Raj *et al*.[10] found no significant gender difference among the Khammam population (South India). A more pronounced mentolabial angle can be seen in Class II and vertical maxillary

deficiency cases. The uprighting of the lower incisors tends to enlarge the angle Bergman.[15] The mean value according to Burstone[17] is 122.0 ± 11.7°. In the present sample, there was a gender difference for this angle. For the males, the value was 121.10°±10.38° and females were 124.65°±9.92°. In a study by Anić-Milosević *et al*. in Croatian sample, there was a great gender difference for this angle. In a study of Turkish adults, Malkoc *et al*.[14] also found significant gender difference. In the study conducted by Raj *et al*.[10] They found significant gender difference among Khammam population (South India). These results differ from those of Fernández-Riveiro *et al*.[12] and Devi *et al*.[4] which found no significant gender variation and are in agreement with the present study. Lines *et al*.[18] in a study of silhouettes, reported that the mentolabial angle ranged between 120 and 130°. They found that deeper mentolabial sulci were preferred in males. In the current investigation, the females had a shallower mentolabial angle than the males. This is in accordance with the profile preferences published by Lines *et al*.[18] The ideal face of historical beauties, both male and female, according those authors had deeper and more pronounced mentolabial sulcus (around 122°), which gave them a more uniform or similar appearance. According Arnett *et al*.,[3] the upper lip angle reflects the position of the upper incisors and the thickness of the soft tissue overlying these teeth. The upper and lower lip angle (N-Ls/N-Pg and N-Li/N-Pg) was measured from nasion. The mean value of N-Pg/N-Ls angle for male was 9.20° ± 1.76° and for female was 8.57° ± 1.58°. The result of our study shows significant difference between male and female with t = 2.09 and *P* = 0.043. The study conducted by Devi *et al*.[4] showed no statistical significant gender difference on projection of upper lip to chin angle in Bengali population. Similar finding was also observed by Anić-Milosević *et al*.[13] in their study in Caucasian population and among Khammam population. Arnett *et al*.[3] measured this angle from subnasal to upper lip and found that this angle was another angle that reflected the position of upper incisors and the thickness of the soft tissue overlying these teeth. In our study, the projection of the lower lip to chin angle (N-Pg/N-Li) was 4.46° ± 0.89° for males and for females was 4.33° ± 0.98°. Thus, the result showed a significant difference between male and female with t = 0.70 and *P* = 0.48 in M.P population. Whereas in the study conducted by Devi *et al*.,[4] the value was 3.8 ± 1.8° in males and 3.9 ± 1.9° in females. The angle was found with no gender difference. Similar finding was also seen in the study done by Raj *et al*.[10] This finding showed agreement with Anić-Milosević *et al*.[13] where mean value was 3.27 ± 1.7° for males and 3.6 ± 1.4° for females with no gender difference among Caucasian population. The nose tip angle (N-Prn-Cm) in the study conducted by Devi *et al*.[4] was found having no significant gender difference (males = 113.53 ± 4.4°; females = 114.76 ± 3.7°). Anić-Milosević *et al*.[13] in Caucasian population with good soft-tissue, profile found gender dimorphism.

Conclusion

The soft-tissue values obtained from this sample can be used as standards in comparisons of subjects with the same ethnic characteristics, a dental Class I occlusion, and a good soft-tissue profile. The derived soft-tissue values can be considered as normal values for Madhya Pradesh population and used for comparison of subjects with malocclusion, thereby providing orthodontists for proper diagnosis and treatment plan of any malocclusion-associated soft-tissue segments of the face. However, further experiments are to be suggested with a larger sample size through a meticulous screening procedure for standardization of norm.

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