Original Article

Angular Photogrammetric Soft Tissue Facial Profile Analysis of Bangladeshi Young Adults

Lubna Akter, Md. Zakir Hossain[1]

FCPS Part II Trainee, [1]Professor and Head, Department of Orthodontics and Dentofacial Orthopedics, Dhaka Dental College and Hospital, Dhaka, Bangladesh

Abstract

Introduction: Angular photogrammetric soft tissue facial profile analysis provides a permanent record for the actual appearance of a person, which would also serve to establish an ideal esthetic treatment goal. The aim of the present study was to evaluate the average angular variables that define the soft tissue facial profile of a Bangladeshi sample. **Materials and Methods:** This cross-sectional study was carried out at Department of Orthodontics and Dentofacial Orthopedics of Dhaka Dental College and Hospital, Bangladesh, from July to December 2015. Soft tissue facial profiles of 200 participants (100 males and 100 females) between 18 and 25 years of age, with a dental Class I occlusal relationship and harmonious soft tissue profile, were selected by convenience sampling among students, doctors, and patients of Dhaka Dental College. Standardized photographs of 200 samples were taken in the natural head position. The photographic records were analyzed with the software for Windows, Microsoft Visio 2007, Standard Edition. All data were analyzed through standard methods using Statistical Package for the Statistical Package for Social Science Software (SPSS Version-20, IBM Corp, USA). **Results:** The average angular measurements for nasofrontal, total facial angle, facial angle, upper lip angle, projection of lower lip to chin, and mentolabial angle were wider in females. The mean value for nose tip angle, nasolabial angle, nasomental angle, and projection of upper lip to chin angle was higher in males compared to females. Nasofrontal angle (G-N-Nd) ($P = 0.000$) and mentolabial angle (Li-Sm-Pg) ($P = 0.001$) showed statistically significant differences. The greatest variability was found for mentolabial angle. **Conclusion:** The study of angular photogrammetric soft tissue facial profile analysis of Bangladeshi young adults contributes to the establishment of standardized normal values for the population. This study provides data which can be used in treatment planning by specialists such as orthodontists, prosthodontists, plastic surgeons, and maxillofacial surgeons, who have the capability to change the soft tissue facial features.

Keyword: *Angular measurement, photogrammetry, soft tissue facial profile, standardized photographs*

Introduction

The face is the most important feature which is visible on first sight for a human being. Soft tissue of the face together with the underlying dentoskeletal tissues defines the facial traits of a person.[1] Social acceptance, psychological well-being, and self-esteem of an individual are related to physical appearance. The perception of an attractive face is largely subjective with ethnicity, age, gender, culture, and personality influencing average facial traits.[2,3] Interestingly, facial features are usually studied in profile.[4] Orthodontic diagnosis and treatment planning are increasingly being based on profiles rather than merely on Angle's concept of molar relationship.[5] It was recognized that certain skeletal angular criteria, amount of tonicity of the soft tissue, and facial muscular posture can influence the appraisal of the profile.[6]

Tooth movement (orthodontic or surgical) used to correct the bite can negatively impact facial esthetics, especially if pretreatment esthetics are not defined before treatment.[7] Several specialists such as orthognathic and plastic surgeons, orthodontists, and prosthodontists or anyone working in the maxillofacial discipline need to know the standard of the face of a specified ethnic group, which may then guide the repair of affected areas in their patients.[8] One such standard is provided by anthropometric measurements on photographs and is known as photogrammetry.[9] It is a relatively simple method for clinical application and is also relatively noninvasive and low cost. In

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Address for correspondence:
Dr. Lubna Akter, Department of Orthodontics and Dentofacial Orthopedics, Dhaka Dental College and Hospital, Mirpur-14, Dhaka-1216, Bangladesh. E-mail: lubna.akter3@gmail.com

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addition, it avoids inconvenience to the participants and also saves valuable time. Hence, this article aims to perform a standardized angular photogrammetric soft tissue facial profile analysis to provide a permanent record for the actual appearance of a Bangladeshi sample.

Materials and Methods

A cross-sectional study was conducted from July 2015 to December 2015 in the Department of Orthodontics and Dentofacial Orthopaedics, Dhaka Dental College and Hospital, Mirpur-14, Dhaka, Bangladesh. The study population consisted of 200 (100 male and 100 female) Bangladeshi graduate and postgraduate students, doctors, and patients in the age group of 18–25 years. To be included, participants had to have a complete set of permanent dentition with Angle's Class I occlusion, normal overjet and overbite, and a pleasing and balanced facial profile. Participants with following criteria were excluded from the study – (a) exhibiting apparent craniofacial anomalies, facial disharmony, or other pathologies either skeletally or in soft tissues, (b) history of previous orthodontic treatment or maxillofacial surgery, and (c) unable to determine natural head position. After getting approval from the Ethical Committee of Dhaka Dental College and Hospital (Ref. D.D.C/1058 Date: July 10, 2014), study participants between 18 and 25 years of age were selected by convenience sampling. All participants participating in the study had to sign a written informed consent form, which was also provided in a translated native language (Bengali) version for better understanding. The photographic setup consisted of a tripod supporting a digital camera (Canon Power Shot A2400 IS). Distance between the camera and the participant was fixed at 3.5 ft, and recording was carried out by employing the following methodology:

- Adjustment of the tripod height allowed the optical axis of the lens to be maintained in a horizontal position during the recording; this was adapted to each participant's body height
- The same illumination was used for photography of each individual
- A plumb line, supporting a 0.5 kg weight suspended from the scale, held by a thick black thread was used to define the vertical plane (true vertical [TV]) on the photographs. Behind the participant, there was a graph paper (universal background) divided into millimeters that allowed measurements in life size. Each photograph was reduced to real size, overlaid over the calibrating gauge, and orientated so that the TV line on the photograph was parallel with the vertical line of the computer monitor
- In a sitting position, each participant was asked to relax. The participants had to look forward in the imaginary mirror, and the right-side profile records were photographically captured in natural head position [Figure 1]. Before every recording, the operator ensured that the participant's forehead, neck, and ear were clearly visible and their lips were in repose. All procedures were undertaken by the same operator
- The photographic records were analyzed with the software for Windows, Microsoft® Visio® 2007, Standard Edition.

All photographs thus captured were scaled to life size, and the landmarks [Figure 2] were located on the digitized image to obtain all angular measurements [Figures 3-5]. The photogrammetric parameters which were measured are described below:

1. Total facial angle or facial convexity including the nose (N-Prn-Pg) - angle between nasion (N) to tip/pronasale (Prn) line and pronasale (Prn) to pogonion (Pg) line
2. Facial angle or facial convexity excluding the nose (G-Sn-Pg) - angle between glabella to subnasale (Sn) line and subnasale (Sn) to pogonion (Pg) line
3. Nasomentalangle (N-Prn/N-Pg) - angle between nasion (N) to pogonion line (Pg) and nasion to tip (Prn) line
4. Nose tip angle (N-Prn-Cm) - angle between nasion (N) to tip/pronasale line (Prn) and tip to columella (Cm) line
5. Nasolabial angle (Cm-Sn-Ls) - angle between columellar point (Cm) to subnasale line (Sn) and subnasale to labiale superior (Ls) line
6. Mentolabial angle (Li-Sm-Pg) - angle between labiale inferior point (Li) to supramentale line (Sm) and supramentale to pogonion (Pg) line
7. Nasofrontal angle (G-N-Nd) - angle between glabella (G) to nasion (N) line and nasion to nasal dorsum (Nd) line
8. Projection of upper lip to chin (N-Pg/N-Ls) - angle between nasion (N) to pogonion (Pg) line and nasion to labiale superior (Ls) line
9. Upper lip angle (Sn-Ls/Sn-Pg) - angle between subnasale (Sn) to labiale superior (Ls) line and subnasale to pogonion (Pg) line
10. Projection of lower lip to chin (N-Pg/N-Li) - Angle

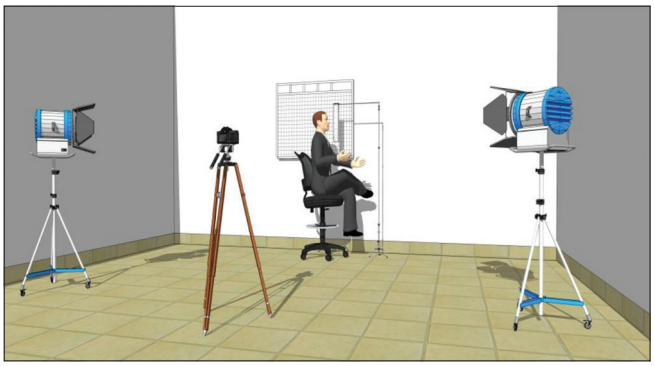

Figure 1: Photographic Technique

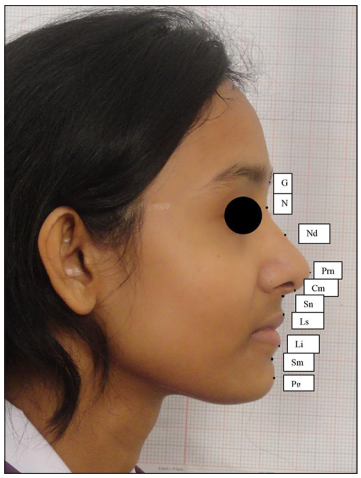

Figure 2: The landmarks used in this investigation: Glabella (G), nasion (N), nasal dorsum (Nd), pronasale (Prn), columella (Cm), subnasale (Sn), labiale superior (Ls), labiale inferior (Li), supramentale (Sm), pogonion (Pg)

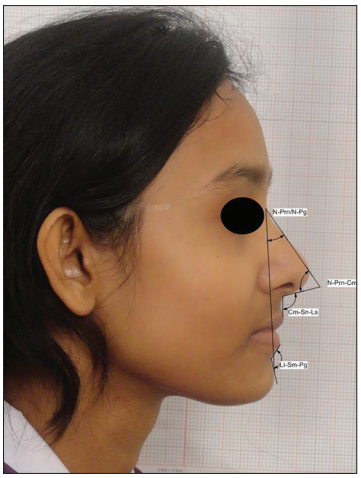

Figure 3: Angular measurements: nasomental angle (N – Prn/N – Pg); nose tip angle (N – Prn – Cm); nasolabial angle (Cm – Sn – Ls); mentolabial angle(Li – Sm – Pg)

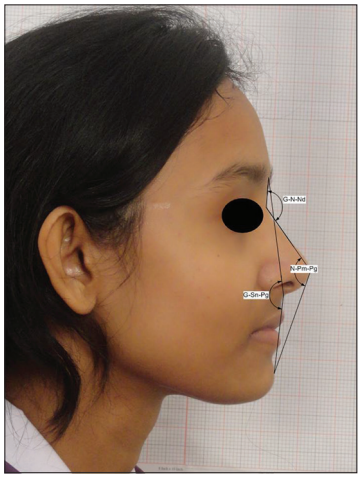

Figure 4: Angular parameters of the nasofrontal angle (G – N – Nd); total facial angle or facial convexity including the nose (N – Prn – Pg); facialangle or angle of facial convexity excluding the nose (G – Sn – Pg)

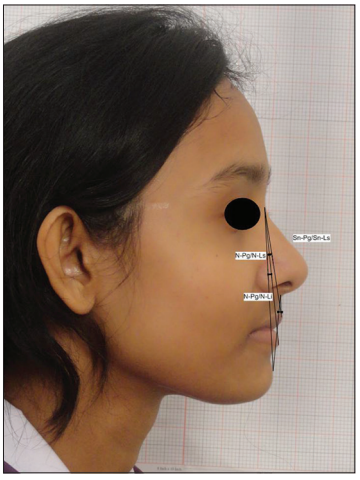

Figure 5: Projection of the upper lip to chin (N – Pg/N – Ls); upper lip angle (Sn – Ls/Sn – Pg); projection of the lower lip to chin (N – Pg/N – Li)

between nasion (N) to pogonion (Pg) line and nasion to labiale inferior (Li) line.

The photographic records were analyzed with the software for Windows, Microsoft® Visio® 2007, Standard Edition. All data were analyzed through standard statistical methods using Statistical Package for Social Science Software (SPSS Version-20, IBM Corp, USA). Descriptive statistical analysis such as mean, with maximum and minimum values, and standard deviation was used. The confidence level was set at 95% so that "*P*" value was significant at <0.05. To compare male and female categories, Student's *t*-test was used.

Results

The average angular measurements for different parameters of sample are shown in Table 1 (all participants), Table 2 (100 males and 100 females), and *t*-test in Table 3. The greatest variability was found for mentolabial angle, which had the highest standard deviation. Statistically significant gender differences were found for two angles - nasofrontal angle (G-N-Nd, $P = 0.000$) and mentolabial angle (Li-Sm-Pg, $P = 0.001$). Graphical comparison with different studies for the values of these two angles is shown in Figures 6 and 7. In this study, most of the angles such as nasofrontal, total facial, facial, upper lip, lower lip to chin, and mentolabial were wider in females than males [Table 4]. Whereas nose tip angle, nasolabial angle, nasomental angle, and upper lip to chin angle were higher in males compared to females [Table 5].

Discussion

The aim of this study was to evaluate the angular variables defining the soft tissue facial profile of a Bangladeshi sample which typically used for esthetic treatment goals. On analysis of 100 males and 100 females from the Bangladeshi population, the greatest variability was

found for mentolabial angle. Most of the angles such as nasofrontal, total facial, facial, upper lip, lower lip to chin, and mentolabial were wider in females than males [Table 4], whereas nose tip angle, nasolabial

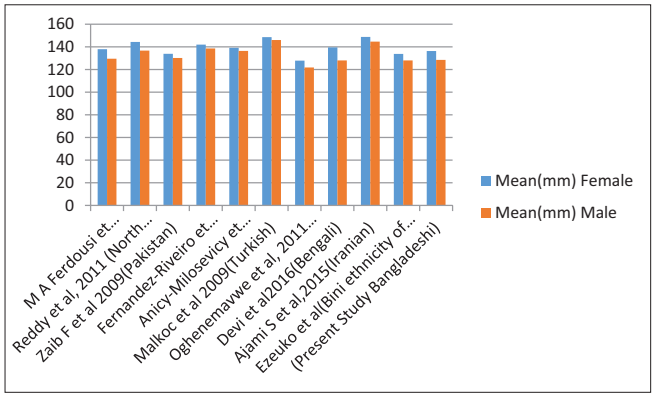

Figure 6: Nasofrontal (G-N-Nd) angle in different studies

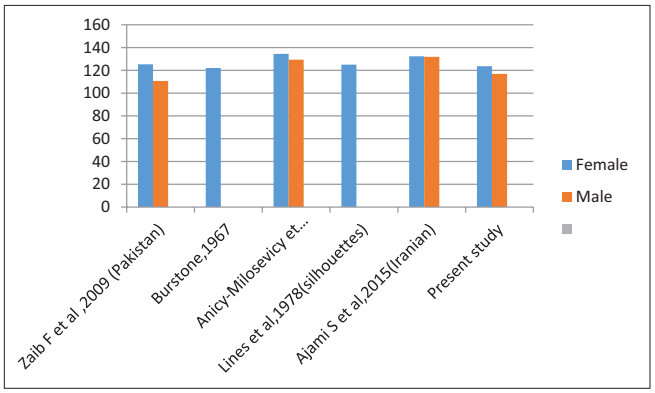

Figure 7: Mentolabial (Li-Sm-Pg)angle in different studies

Table 1: Descriptive Statistics of angular measurement of all sample

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Nasoforontal Angle (G-N-Nd)	200	112	149	132.39	8.015
Total Facial Angle (N-Prn-Pg)	200	118	138	127.38	4.533
Facial Angle (G-Sn-Pg)	200	152	177	165.43	4.768
Nose Tip Angle (N-Prn-Cm)	200	57	92	70.61	5.433
Nasolabial Angle (Cm-Sn-Ls)	200	74	114	92.78	8.521
Nasomental Angle (N-Prn/N-Pg)	200	25	40	32.58	3.282
Mentolabial Angle (Li-Sm-Pg)	200	68	159	120.28	15.248
Projection of upper lip to chin (N-Pg/N-Ls)	200	4	14	9.15	2.307
Upper lip Angle (Sn-Ls/Sn-Pg)	200	5	38	19.23	7.030
Projection of Lower Lip to Chin (N-Pg/N-Li)	200	2	9	4.84	1.648
Valid N (listwise)	200				

The greatest variability was found for mentolabial angle (Li-Sm-Pg), which had the highest standard deviation

Table 2: Descriptive Statistics of angular measurement of male& female

Variable	Gender	No	Range	Min	Max	Mean	Std. Deviation
Nasoforontal Angle (G-N-Nd)	Male	100	34	112	146	128.47	7.538
	Female	100	28	121	149	136.32	6.408
Total Facial Angle (N-Prn-Pg)	Male	100	20	118	138	127.29	4.421
	Female	100	19	119	138	127.49	4.747
Facial Angle (G-Sn-Pg)	Male	100	25	152	177	165.22	5.04
	Female	100	20	156	176	165.63	4.514
Nose Tip Angle (N-Prn-Cm)	Male	100	35	57	92	70.9	6.744
	Female	100	17	61	78	70.34	3.715
Nasolabial Angle (Cm-Sn-Ls)	Male	100	40	74	114	94.09	9.804
	Female	100	36	74	110	91.44	6.924
Nasomental Angle (N-Prn/N-Pg)	Male	100	14	26	40	32.69	3.268
	Female	100	15	25	40	32.49	3.41
Mentolabial Angle (Li-Sm-Pg)	Male	100	91	68	159	116.91	14.604
	Female	100	56	92	148	123.66	15.108
Projection of upper lip to chin (N-Pg/N-Ls)	Male	100	10	4	14	9.23	2.399
	Female	100	9	5	14	9.06	2.326
Upper lip Angle (Sn-Ls/Sn-Pg)	Male	100	33	5	38	18.71	7.971
	Female	100	24	8	32	19.67	5.992
Projection of Lower Lip to Chin (N-Pg/N-Li)	Male	100	6	2	8	4.71	1.445
	Female	100	7	2	9	4.93	1.865

Table 3: Application of t test in relation to sex parameters

Parameters	t	Df	*P*
Nasoforontal Angle (G-N-Nd) of Male - Female	-8.775	99	.000* HS*
Total Facial Angle (N-Prn-Pg) Male - Female	-.299	99	.765 NS
Facial Angle (G-Sn-Pg) Male - Female	-.623	99	.535 NS
Nose Tip Angle (N-Prn-Cm) Male - Female	.784	99	.435 NS
Nasolabial Angle (Cm-Sn-Ls) Male – Female	2.243	99	.027 NS
Nasomental Angle (N-Prn/N-Pg) Male - Female	.449	99	.655 NS
Mentolabial Angle (Li-Sm-Pg) Male- Female	-3.359	99	.001** VS
Projection of upper lip to chin (N-Pg/N-Ls) Male – Female	.527	99	.599 NS
Upper lip Angle (Sn-Ls/Sn-Pg) Male - Female	-1.011	99	.315 NS
Projection of Lower Lip to Chin (N-Pg/N-Li)Male Female	-.996	99	.322 NS

Table 4 : Comparison of various angular variables of soft tissue facial profile between male and female

Parameter	Female	Male
Nasofrontal angle (G-N-Nd)	136.32±6.408°	128.47±7.538°
Total facial angle (N-Prn-Pg)	127.49±4.747°	127.29±4.421°
Facial angle (G-Sn-Pg)	165.63±4.514°	165.22±5.040 °
Upper lip angle (Sn-Ls/Sn-Pg)	19.67±5.992°	18.71±7.971°
Lower lip to chin angle (N-Pg/N-Li)	4.93±1.865°	4.71±1.445°
Mentolabial angle(Li-Sm-Pg)	123.66±15.108°	116.91±14.604°

Table 5: Comparison of various angular variables of soft tissue facial profile between male and female

Parameter	Male	Female
Nose tip angle (N-Prn-Cm)	70.90±6.744°	70.34±3.715°
Nasolabial angle (Cm-Sn-Ls)	94.09±9.804°	91.44±6.924°
Nasomental angle (N-Pg /N-Prn)	32.69±3.268°	32.49±3.410°
Upper lip to chin (N-Pg/N-Ls)	9.23±2.399°	9.06±2.326°

angle, nasomental angle, and upper lip to chin angle had higher values in males compared to females [Table 5]. Statistically significant gender differences were found for two angles - nasofrontal angle (G-N-Nd, $P = 0.000$) and mentolabial angle (Li-Sm-Pg, $P = 0.001$). Details are discussed in the section below.

Nasofrontal angle (G-N-Nd)

The present study showed that the mean value of nasofrontal angle for 200 samples was 132.39° ± 8.015°. The nasofrontal angle (G-N-Nd) showed gender dimorphism ($P = 0.00$; males = 128.47°, females = 136.32°). Statistically significant ($P < 0.05$) and the higher mean value was found in females as compared to males. The mean value of the study was much closer to the values in studies by Devi *et al*. (Bengali, west)[10] males = 128.06° and females = 139.568°, Ezeuko and Eboigbe (adult Bini ethnicity of Nigeria)[8] males = 128° ± 0.6° and females = 133.8°, Ferdousi *et al*. (Bangladeshi Garo)[9] males = 129.56° ± 7.96° and females = 137.96° ± 4.79°, and Zaib *et al*. (Pakistani)[5] males = 130.1667° ± 5.305° and females = 133.8567° ± 5.573°.

The mean values of the current study were lesser than the values in studies by Reddy *et al*. (North Indian)[11] males = 136.71° ± 3.64° and females = 144.33° ± 1.75°, Anić-Milosević *et al*. (Croatian)[4] males = 136.38 ± 6.71° and females = 139.11° ± 6.35°, Fernandez-Riveiro *et al*., (Spanish)[12] males = 138.57° ± 6.81° and females = 141.98° ± 6.06°, Malkoç *et al*. (Turkish)[13] males = 146.03° ± 8.19° and females = 148.61° ± 6.66°, and Ajami *et al*. (Iranian)[14] males = 144.67° and females = 148.78°. The mean value in the present study was greater than the study by Oghenemavwe *et al*. (Urhobos),[15] with values of males = 121.75° ±9.07° and females = 127.85° ± 8.50°.

Total facial angle or facial convexity including the nose (N-Prn-Pg)

The mean value of total facial convexity of the total population of Bangladeshi young adults was 127.38° ± 4.533°. The value for males was 27.29° ± 4.421° and females was 127.49° ± 4.747°, with gender differences not being statistically significant. These values were similar to the values given by Reddy *et al*. (North Indian)[11] 127.71° ± 1.97° for males and 127.11° ±1.81° for females but lesser in comparison to those in studies by Pattanaik and Pathuri (Southern India; males = 130.82° and females = 131.71°)[16] and Anić-Milosević *et al*. (Croatian; males = 130.47 ± 3.73° and females = 130.19 ± 3.47°).[4] Fernández-Riveiro *et al*.[12] and Bishara *et al*.[17] measured the angle from glabella, not from nasion and found higher values. Bishara *et al*.[17] stated that between 25 and 45 years of age, the angle increased by 2.1° and 1.3° in males and females, respectively, reflecting either a more vertical growth of the tip of the nose or a more forward movement of soft tissue pogonion.

Facial angle or facial convexity excluding the nose (G-Sn-Pg)

The profile angle was used to assess the convexity or concavity of the facial profile. According to Bergmann (1999),[18] Class I participants presented an angle ranging from 165° to 175°. The average value of this angle in this study was 165.43° ± 4.768°. Mean value for males was 165.22° ± 5.040° and for females was 165.63° ± 4.514° which was similar to the values given by Devi *et al*. (Bengali; males = 165.138° and

females = 168.52°)[10] and Moshkelgosha *et al*. (Persian; males = 165.17 and females = 165.9°).[19] This value was slightly less than the values given by Anić-Milosević *et al*. (males = 168.78 ± 4.9° and females = 169.05 ± 4.69°)[4] and Malkoç *et al*. (males = 170.60 ± 6.15° and females = 168.78 ± 5.44°).[13]

It was suggested that Bangladeshi males may have slightly more convex face compared to females; however, in this study, no gender dimorphism was found.

Nose tip angle (N-Prn-Cm)

In this study, the average value of nose tip angle was 70.61° ± 5.433°. Mean value for males was 70.90° ± 6.744° and for females was 70.34 ± 3.715°. These values were lesser than those in studies by Reddy *et al*. (males = 75.09° ± 3.17° and females = 75.35° ± 3.08°),[11] Anić-Milosević *et al*. (males = 79.85 ± 6.36° and females = 84.12 ± 5.2°),[4] and Moshkelgosha *et al*., (males = 79.6° and females = 84.7°).[19] According to Lines *et al*., most acceptable values of the angle fall between 60° and 80°.[20] A sharper nasal tip in Bangladeshi population was due to decreased nasolabial angle. No pronounced differences were observed in male and female values.

Nasolabial angle (Cm-Sn-Ls)

The nasolabial angle evaluates the relationship of the nasal base and upper lip. Because its magnitude depends on the anteroposterior position and inclination of the upper anterior teeth, it can be altered by orthodontics or orthognathic surgery.[21] According to Bergman,[18] the ideal value of this angle should be 102° ±8°. This was used as part of the extraction decision. In the study of Talass *et al*.[22] of Class II malocclusion participants where premolars were extracted, 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 average value of nasolabial angle of Bangladeshi sample was found to be 92.78° ± 8.521°, with values of 94.09° ±9.804° for males and 91.44° ± 6.924° for females. These were close to the mean values given by Zaib *et al*. in a Pakistani population (males = 95.8333° ± 6.131° and females = 92° ± 7.37°)[5] and by Ferdousi *et al*. in a Bangladeshi Garo population (males = 91.28° ± 12.98° and females = 91.92° ± 8.90°).[9] The values were lesser than those in studies by Reddy *et al*. (males = 102.32° ± 4.69° and females = 101.50° ± 4.39°),[11] Anić-Milosević *et al*. (males = 105.4° ± 9.5° and females = 109° ± 7.8°),[4] and Moshkelgosha *et al*. (males = 107.28° and female = 111.2°).[19] This can be attributed to the fact that the Bangladeshi population has a much fuller profile in comparison to the Caucasian. No Significant sexual dimorphism was observed.

Nasomental angle (N-Prn/N-Pg)

According to Lines *et al*., nasomental angle (N– Prn/N–Pg) is esthetically most acceptable within a range of 20°–30°.[20] Statistically significant gender differences showed that a less prominent nose in relation to the chin is preferable in females and the opposite in males. Clements stated that the nasal prominence angle (nasomental angle) was around 30° or less in most faces which was illustrated in art throughout history.[23] According to Hinds and Kent, the normal value is between 23° and 37°, with an average of approximately 30°.[24] In the present study, mean value was 32.58° for total sample, 32.69° ± 3.268° for males and 32.49° ± 3.410° for females. The values were lesser than in Reddy *et al*.'s study (males = 34.38° ± 1.77° and females = 33.69° ± 1.37°)[11] and in Ferdousi *et al*.'s study (males = 40.27° ± 4.54° and females = 38.67 ± 4.05°)[9] but greater than in Pattanaik and Pathuri study (males = 27.11° and females = 26.58°)[16] and Anić-Milosević *et al*. study (males = 29.53° ± 2.51° and females = 30.36° ± 2.38°).[4] This could probably be attributed to the observation that the Bangladeshi population has less prominent nose than North Indian, Bengali population, but more than Caucasian European population. Bangladeshi population has a more convex total facial profile in comparison to the white European population. No significant gender differences were found.

Mentolabial angle (Li-Sm-Pg)

Mentolabial angle also showed great variability. The uprighting of the lower incisors tends to enlarge the angle.[18] The mean value according to Burstone is 122.0° ± 11.7°.[25] In the present study, greatest variability was found for this angle. The average value of mentolabial angle for overall population was 120.28° ± 15.248°, 116.91° ± 14.604° for males and 123.66° ± 15.108° for females, comparable to values of Zaib *et al*.'s study with values of 110.73° ± 12.784° for males and 125.2667° ± 7.570° for females.[14] The mean value of the present study was less than the values given by Ajami *et al*. (males = 131.82° and females = 132.32°)[14] and Anić-Milosević *et al*. (males = 129.3° ± 9.5°, females = 134.5° ± 9°).[4] Lines *et al*. in a study of Silhouettes reported that the mentolabial angle ranged between 120° and 130°.[20] They found that deeper mentolabial sulci were preferred in males. In this study, the females had a shallower mentolabial angle than the males which is in accordance with the profile preferences.

Projection of upper lip to chin (N-Pg/N-Ls)

Projection of upper lip to chin had a mean value of 9.15° ± 2.307° for overall sample, 9.23° ± 2.399° for males and 9.06° ± 2.32° for females which was larger than the values of 8.61° for males and 8.092° for females reported by Devi *et al*.[10] and 6.98° ± 2.29° for males and 7.17° ± 1.71° for females reported by Anić-Milosević *et al*.[4] Bangladeshi population had a much fuller profile

with differences between gender not being statistically significant.

Upper lip angle (Sn-Ls/Sn-Pg)

The angle that reflects the position of the upper incisors and the thickness of the soft tissue overlying these teeth is the upper lip angle.[26] In the present study, the mean value for this angle was 19.23° ± 7.030°. The average value for males was 18.71° ± 7.97° and for females was 19.67° ± 5.992° which was larger than the values given by Devi *et al*. (males = 12.846° and females = 16.528°)[10] and Anić-Milosević *et al*. (males = 11.70° ±6.20° and females = 12.90° ± 4.82°).[4] The present study showed no significant gender differences for this angle.

Projection of lower lip to chin (N-Pg/N-Li)

Lower lip angle was also measured from Nasion. The mean value was 4.84° ± 1.648°. The average value for males was 4.71° ± 1.445° and for females was 4.93° ± 1.865° which was almost similar to the value given by Pattanaik and Pathuri (males = 4.2° and females = 4.18°)[16] and greater than the value given by Anicy-Milosevicy (males = 3.27° ± 1.79° and females = 3.69 ± 1.39°). Differences between genders were not statistically significant.

Conclusion

Photogrammetric analysis has advantages in facial profile analysis on angular measurements, as they are not affected by photographic enlargement. The present study showed the average angular variables of soft tissue facial profile of Bangladeshi sample. Among them, nasofrontal, total facial angle, facial angle, mentolabial angle, projection of lower lip to chin, and upper lip angle were larger in females, and the average values for nose tip angle, nasolabial angle, projection of upper lip to chin, and nasomental angle were larger in males. The greatest variability was found for mentolabial angle, which had the highest standard deviation. Significant differences in nasofrontal and mentolabial angle were found between males and females. The average values obtained from this sample can be used for comparison with records of participants with the same characteristics and following the same photogrammetric technique and also for diagnosis and treatment planning.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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