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Craniofacial Anthropometric Profile of Adult Ethnic (Santal) people of Northern Part of Bangladesh

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ABSTRACT

Background & objective: Cephalometry is one of the important parts of anthropometry which deals with the study of human head by analyzing various cephalometric points, planes, skeletal and soft tissue relationship of the face in order to determine morphological characteristics in human beings of various ethnic origin. The Santals are one of the major ethnic groups in Bangladesh. But no published data on their craniofacial anthropometrics have yet been found. The present study was designed to assess the normal craniofacial anthropometrics of the Santal population living in Rajshahi Division, the northern part of Bangladesh.

Methods: This descriptive study was conducted for evaluation of craniofacial anthropometrical profile of adult Santals, an ethnic people of Northern part of Bangladesh, particularly in Rajshahi division. The study included a total of 70 Santals (35 males and 35 females ranging from 18-40 years of age) between July 2018 to June 2019. A lateral cephalograph was taken from each study subject and Steiner's analysis was used for cephalometric measurements of the face. The data were collected on various angular measurements, such as SNA angle, SNB angle, ANB angle, UInc to NA angle, LInc to NB angle, interincisal angle, SN to Op angle, SN to GoGn angle (Fig.1). The different angular measurements derived from the Steiner's analysis were then compared between males and females to find whether any of these angles were influenced by sex.

Result: Majority (81.4%) of the study subjects was in their 3rd decade of life with median age of the subjects being 37.0±6.1 (range:18-40) years. SNA angle was approximately normally distributed; SNB was also almost normally distributed, for mean and median SNB were 78.8° and 79° respectively. The mean ANB angle was higher (2.64°) than the median (2.0°). The ANB angle was not assumed to follow a normal distribution curve. UInc to NA (°) is also not normally distributed as the difference between mean (23.6°) and median (25°) is wide. Linc to NB (°) assumed an almost normal distribution curve, for mean (35.4°) and median (35°) are narrowly different. Interincisal angle (°) was also approximately normally distributed as indicated by narrow difference between mean (118.2°) and median (119°). The SN to Op angle (occlusal plane angle) tend to be left-sided skewness. SN to GoGn (mandibular plane angle) shows slight right-sided skewness with negligible difference between mean (33.2°) and median (33.5°). According to Steiner's 'S' line 80% of the facial profile were of protrusive type and the rest 20% were of normal type. However, as different angular measurements were compared between sexes no significant difference was found between sexes.

Conclusion: The Bangladeshi Santal population had a protrusive dento-alveolar structure. These differences should be kept in mind to facilitate better diagnosis, and orthodontic treatment for Bangladeshi patients. The results of the present study support the idea that a single standard of facial esthetics should not be applied to all racial and ethnic groups.

Key words: Craniofacial anthropometrics, adult Santal people, Northern Part of Bangladesh.

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INTRODUCTION:

Anthropometry, from Greek word "Anthropos", meaning "human" and "metron" meaning "measure". Thus, anthropometry refers to the different bodily measurements of the human individual. Cephalometry is one of the important parts of anthropometry which deals with the study of measurement of human head, especially by medical imaging such as lateral cephalometric radiograph.[1] The lateral cephalometric radiograph is a standardized method of analysis of various cephalometric points, planes and skeletal and soft tissue relationship of the face.[2]

Morphological characteristics in human beings are affected by ecological, biological, geographical, racial, gender and age factors. Most studies have emphasized the importance of anthropometric studies on the basis of the above factors. This necessity rests on the fact that there will be greater validity if an individual is compared to referent data matched for their specific ethnic, sex and age group. A hallmark of the diversity and individuality of the people encountered in daily life is the range of variations in the shape of their faces. Studies on craniofacial relations and variations in man assists in understanding the frequency distribution of human morphologies. Craniofacial anthropometrics have become an important tool for genetic councilors to identify any dysmorphic syndromes. Measurements taken from an individual can be compared with the normal values obtained from a reference population and deviations from the ideal values can be evaluated. Cephalometric results are also used in forensic medicine for facial reconstruction, a technique, to recreate an individual's face for the purpose of identification. These data are helpful in identifying the deceased, especially in investigations of genocide and mass death resulting from wars, accidents, terrorist attacks and so forth. These results are also used in plastic and reconstructive surgery, oral surgery, and dentistry to treat any congenital or post-traumatic facial disfigurements in members of different ethnic groups. An ideal reference value helps clinicians to determine the degree of deviations and to assess any improvement achieved through treatment.[3] Therefore, it is clear (and well-established as well) that a single standard of facial aesthetics is not appropriate for the application to diverse racial and ethnic groups.

The Santals are one of the major ethnic groups in Bangladesh. They mainly live in the districts of Rajshahi division. Their principal home was in Radha (in West Bengal), the forests of adjacent Bihar (Jharkhand) and Odisha and Chotonagpur, Santal Pargana of India. Rough estimates from different sources revealed that there was approximately 1,50,000 Santal population in Bangladesh in 1984. However, update information about this population cannot be provided due to absence of tribe-wise breakdown of national population census report in Bangladesh. They are the descendants of austric-speaking proto-australoid race. They are dark-complexioned, average-statured, long-headed with black and curled hair, broad nose and heavy lips.[4]

As no published data on craniofacial anthropometrics of adult ethnic people like Santals, an ethnic minority in the Northern part of Bangladesh, especially in Rajshahi are available at present, a study was designed to assess the normal measurements of the craniofacial anthropometrics of this population using Steiner's Analysis. The findings derived from the study may serve as future reference data of craniofacial anthropometrics for this ethnic group.

METHODS:

This cross-sectional descriptive study was conducted in the Department of Anatomy, Rajshahi Medical College, Rajshahi. Data were collected from Santal population living in different zones of Rajshahi Division (Babuldaing, Paitapukur, Nimghutu, Modhumath, Polashbari, Godagari, Go-gram, Rajshahi Court Mission campus, Baganpara, Tultulipara, Rajshahi Mission Hospital) over a period of one (01) year from July 2018 to June 2019. Santal people (ranging from 18-40 years) having normal healthy profile, angle class 1 molar relationship with complement of permanent dentition up to the 2nd molar in the proper intercuspal position were the study population. However, subjects with history of orthodontic treatment, gross carious lesion or periodontal disease and history of facial trauma were excluded from the study. A total of 70 Santals (35 male and 35 female) who met the above-mentioned

eligibility criteria were included in the study. The risk and benefits of participating in the study were explained to the subjects interested in participating the study. They were also informed that participation in the study was voluntary. Then written informed consent was taken from those who voluntarily consented to participate in the study.

STUDY PROCEDURE:

(i) Procedure of Radiography:

Having obtained ethical clearance from the Ethical Committee of Rajshahi Medical College, Rajshahi, a lateral cephalograph was taken from each study subject for collection of cephalometric data. The X-ray plate enclosed in a light tight cassette kept parallel to the midsagittal plane of the subject and X-rays projected perpendicular to it. The skull of the subject was kept in a position so that the Frankfurt horizontal plane was parallel to the floor. Each subject was asked to stand erect, hanging the upper limbs by the side of the body and instructed to look straight and maintain a relaxed posture with teeth in centric occlusion and lips relaxed during the exposure of the films. X-ray films were exposed to an electric current of 61-85 Kvp and 4-10 mA with an exposure of 1.2 seconds.

(ii) Procedure of examination:

The lateral cephalograph was traced upon A4 size paper with a 2B hard lead pencil over a well-illuminated viewing screen. Each cephalograph traced according to Steiner's reference point. The midline of the double contour bilateral structures was drawn to minimize error caused by head positioning. The angular measurements were recorded with a measuring degree up to a precision of 0.5º. The result was then prepared for each tracing. Figure of Steiner's method is presented in the next page and clarification was as follows-

A point (A): A point was taken at the deepest concavity anteriorly on the maxillary alveolus.

B point (B): A point was taken at the deepest concavity anteriorly on the symphysis menti.

Sella (S): A point was taken at the midpoint of the sella turcica (pituitary fossa).

Nasion (N): A point was taken at the most anterior point on the fronto-nasal suture.

Orbitale (Or): A point was taken at the most anterior and inferior point on the infraorbital rim.

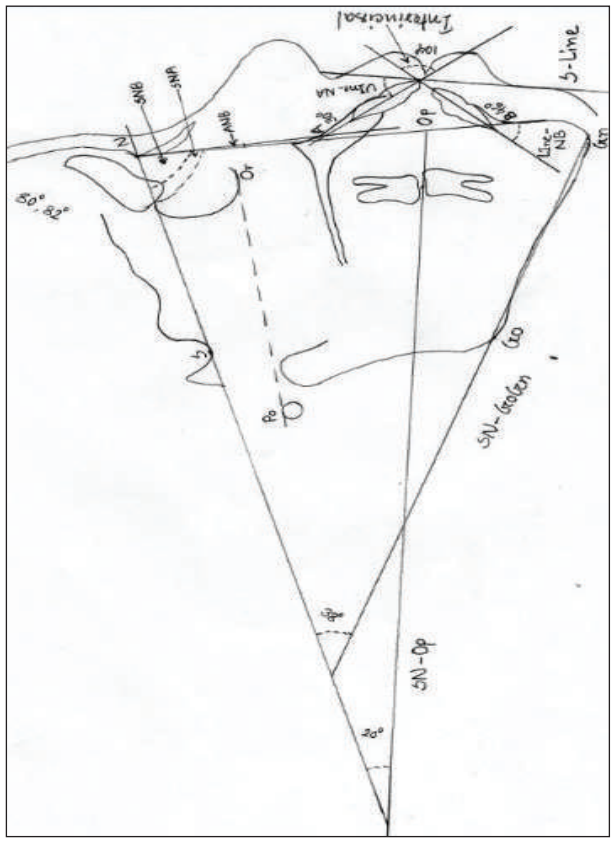
Porion (Po): A point was taken at the upper midpoint on the external auditory meatus.

Gonion (Go): A point was taken at the most postero-inferior part on the mandibular angle.

Gnathion (Gn): A point was taken at the most antero-inferior point on the symphysis menti.

SN plane: The plane demonstrated by a line through joining the nasion and sella.

Frankfurt Plane: The plane demonstrated by a line through joining the orbitale and porion.



Reference points according to Steiner's analysis. (Steiner C.C, 1953)

Mandibular plane: The plane demonstrated by a line through joining the gonion and gnathion.

SNA angle: This angle was drawn by joining the sella, nasion and A point.

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SNB angle: This angle was drawn by joining the sella, nasion and B point.

ANB angle: This angle was the difference between SNA and SNB angle.

Interincisal angle: This angle was drawn where the long axis of the upper incisor and long axis of lower incisor (drawn from a point at the tip and another point at the root of the upper incisor and lower incisor respectively) met.

Maxillary incisor position (UInc to NA): This angle was drawn by joining the long axis of upper incisor with nasion and A point.

Mandibular incisor position (LInc to NB): This angle was drawn by joining the long axis of lower incisor with nasion and B point.

Occlusal plane (Op): This resembled a line drawn from the midpoint between the tips of upper and lower incisors to a point of anterior contact between upper and lower first molar teeth.

Occlusal plane angle (SN to Op): This was the angle where the occlusal plane and the SN plane met.

Mandibular plane angle (SN to GoGn): This was the angle where the SN plane and the mandibular plane met.

S-Line: 'S' line is drawn from the middle of S-shaped curve formed by lower border of nose to the soft tissue contour of the chin.

On completion of data collection, they were checked, verified and edited for consistency and missing data. Data were processed and analyzed with the help of SPSS (Statistical Package for Social Sciences) software program, version 25.0 for windows. Results were analyzed according to the objectives and variables of the study. The test statistics used to analyze the data were descriptive statistics (frequency & corresponding percentage for categorical data and mean, median, standard deviation and range for continuous data) and Unpaired t-Test. Comparison of cephalometric data between males and females was made using Unpaired t-Test. The level of significance was set 5% and p-value < 0.05 was considered significant. The summarized data were presented in the form of tables with necessary interpretations and inferences.

RESULTS:

Age distribution:

Age distribution of the participants shows that over 80% were in their 3rd decade of life. The mean age of the participants was 37.0 ± 6.1 with lowest and the highest ages being 18 and 40 years respectively (table I).

Craniofacial angular measurements:

Different angular measurements (as per Steiner's analysis) of young Bangladeshi Santal population are depicted in table II. Histograms constructed with each of the Steiner's parameters depict the distribution of these parameters (Pic 1 and fig. 1-8). The mean value of the different angles were: SNA-81.5°, SNB-78.8°, ANB-2.64°, UInc to NA-23.6°, LInc to NB-35.4°, Interincisal angle- 118.2°, SN to Op angle-22.5° and SN to GoGn angle-33.3°.

Table I. Distribution of the participants by their age (n = 70):

Age* (years)	Frequency	Percentage
18 – 30	13	18.6
31 – 40	57	81.4

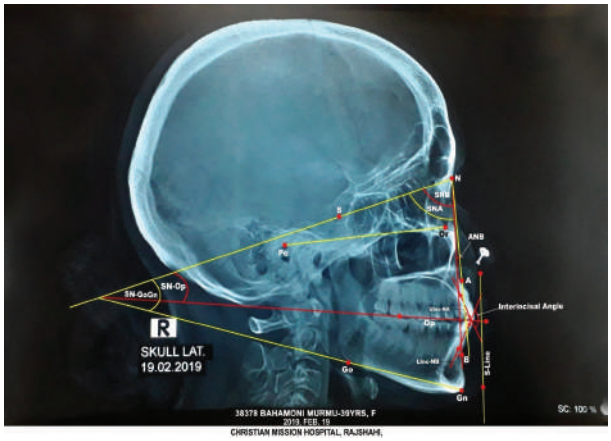
*Mean ± SD = 37.0 ± 6.1 years; range = 18 – 40 years.

Table II. Different craniofacial angular measurements of the participants (n = 70):

Craniofacial angular measurements (°)	Mean	Median	SD	Range
SNA Angle (°)	81.5	82.0	3.2	76 – 91
SNB Angle (°)	78.8	79.0	3.1	73 – 87
ANB Angle (°)	2.64	2.00	0.85	2 – 5
UInc to NA (°)	23.6	25.0	6.4	6 – 40
LIncto NB (°)	35.4	35.0	6.1	25 – 66
Interincisal angle (°)	118.2	119.0	7.6	97 – 137
SN to Op (Occlusal Plane angle) (°)	22.5	22.0	2.6	19 – 29
SN to GoGn (Mandibular plane angle) (°)	33.3	33.5	5.6	33 – 43

As mean and median were marginally different, the distribution of SNA angle was considered as approximately normally distributed (Fig. 1). SNB could be considered as almost normally distributed, for mean and median are 78.8° and 79° respectively (Fig. 2). The curve showing skewness to the left with mean ANB Angle being higher (2.64°) than the

median (2.0°). The ANB Angle did not assume a normal distribution (Fig. 3). UInc to NA (°) is also not normally distributed as the difference between mean (23.6°) and median (25°) is wide (Fig. 4). LIncto NB (°) assumes an almost normal distribution curve, for mean (35.4°) and median (35°) are narrowly different (Fig.5). Interincisal angle (°) data are also approximately normally distributed as indicated by narrow difference between mean (118.2°) and median (119°) (Fig. 6). The data of SN to Op angle (occlusal plane angle) tend to accumulate on the left with left-sided skewness and mean and median do not coincide at one point. The data re not normally distributed (Fig. 7). SN to GoGn (mandibular plane angle) shows slight right-sided skewness. However, as the difference between mean (33.2°) and median (33.5°) is negligibly different, the distribution of SN to GoGn angle could be considered as approximately normal (Fig. 8).



Pic. 1: Different angular measurements taken from lateral cephalograph of a study subject using Steiner's method

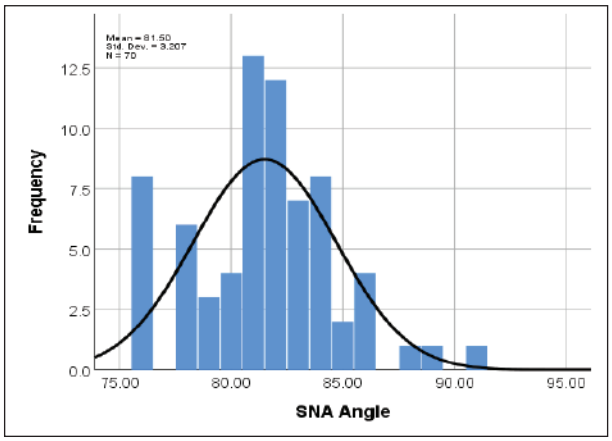


Fig. 1: Histogram showing distribution of SNA angle among the study subjects

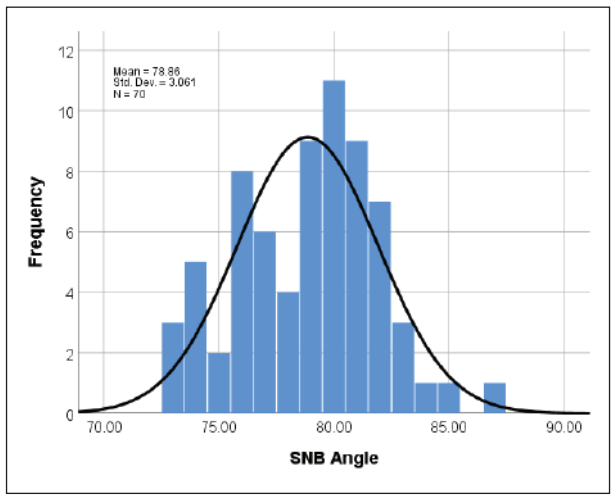


Fig. 2: Histogram showing distribution of SNB angle among the study subjects

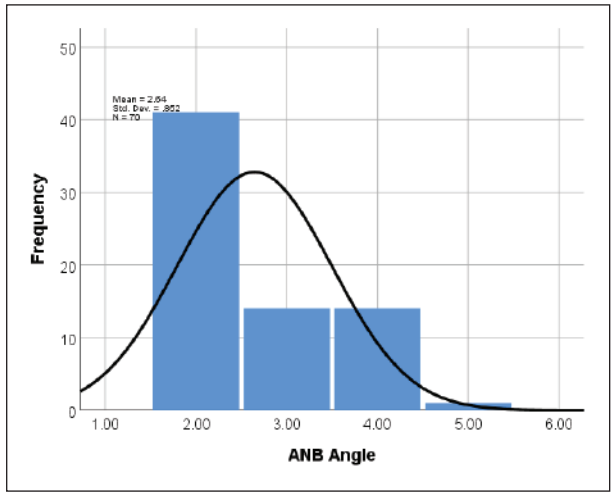


Fig. 3: Histogram showing distribution of ANB angle among the study subjects

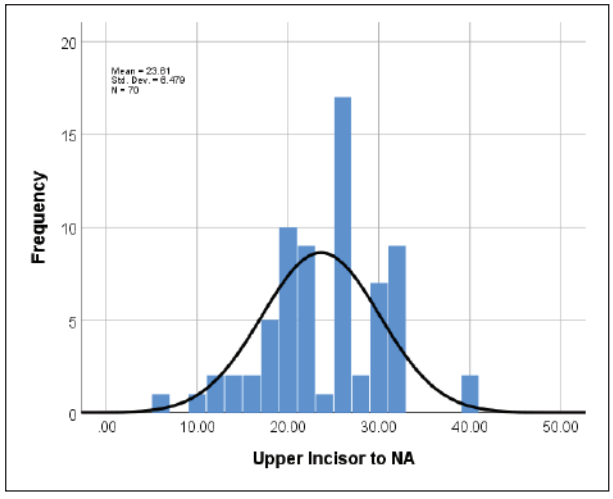


Fig. 4: Histogram showing distribution of UInc to NA among the study subjects.

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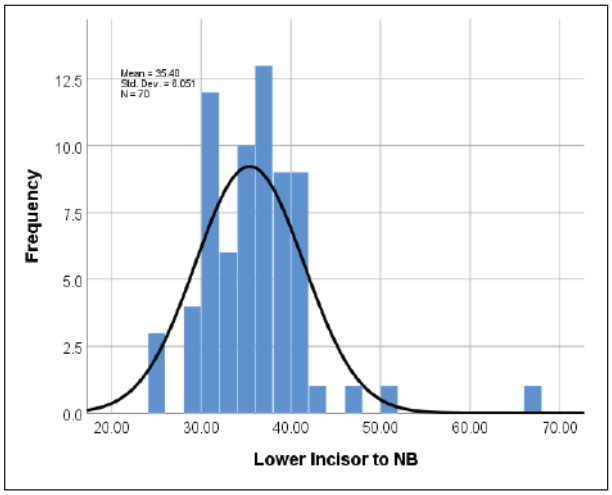

Fig. 5: Histogram showing distribution of LInc to NB among the study subjects.

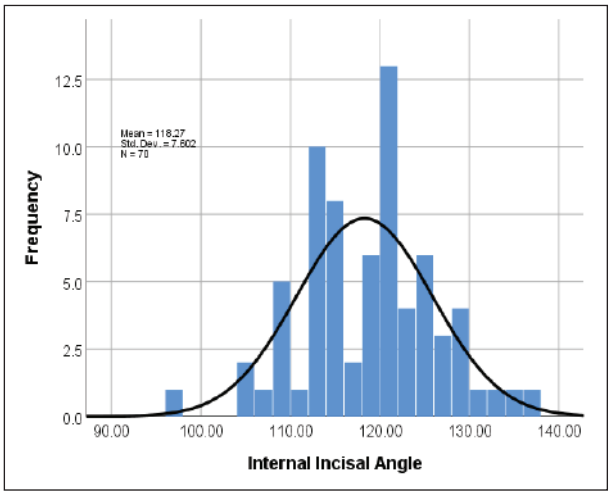

Fig. 6: Histogram showing distribution of interincisal angle among the study subjects

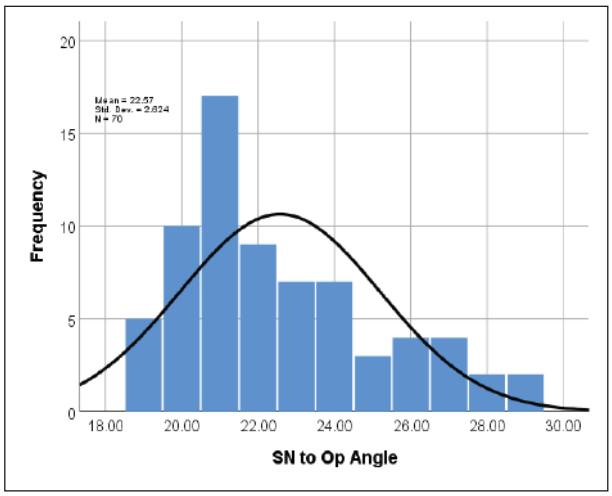

Fig. 7: Histogram showing distribution of SN to Op angle among the study subjects

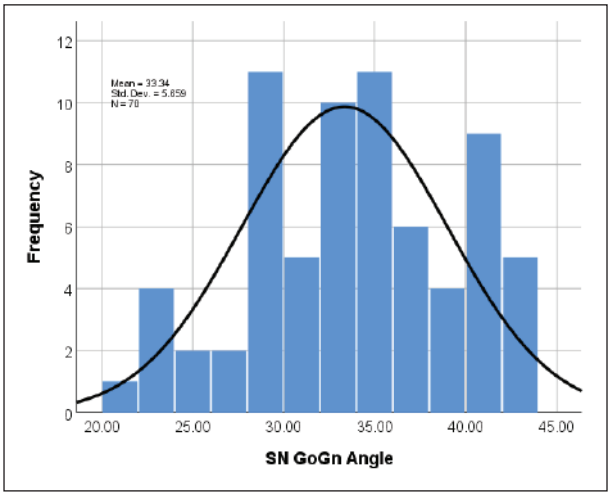

Fig. 8: Histogram showing distribution of SN to GoGn Angle among the study subjects.

Different craniofacial angular measurements in relation to sex:

Different angular measurements of Steiner's analysis were compared between sexes to find whether any of these angles were associated with sex (Table III). No significant difference was found between sexes in terms of SNA, SNB and ANB angles (p = 0.318, p=0.139 and 0.124 respectively). UInc to NA (°), interincisal angle and mandibular plane angle were also no different between males and females (p=0.956, p = 0.744 and p = 0.676 respectively). LInc to NB (°) and SN to Op angle were not found to be significantly different between the sexes (p=0.082 and p = 0.174 respectively).

Facial profile of the adult Santal population:

According to Steiner's 'S' line 80% of the facial profile were of protrusive type and the rest 20% were of normal type (Fig. 9).

Table III. Different craniofacial angular measurements in relation to sex:

Craniofacial angular measurements (°)	Sex		p-value
	Male (n = 35)	Femal (n = 35)	
SNA Angle (°)	81.8 ± 3.0	81.1 ± 3.3	0.318
SNB Angle (°)	79.4 ± 2.9	78.3 ± 2.1	0.139
ANB Angle (°)	2.48 ± 0.74	2.80 ± 0.93	0.124
UInc to NA (°)	23.6 ± 5.2	23.5 ± 7.6	0.956
Linc to NB (°)	34.1 ± 5.2	36.6 ± 6.6	0.082
Interincisal angle (°)	117.9 ± 6.8	118.5 ± 8.4	0.744
SN to Op (Occlusal Plane angle) (°)	23.0 ± 2.8	22.1 ± 2.3	0.174
SN to GoGn (Mandibular plane angle) (°)	33.0 ± 5.8	33.6 ± 5.5	0.676

*Data were analyzed using **Unpaired t-Test** and were presented as **mean ± SD.**

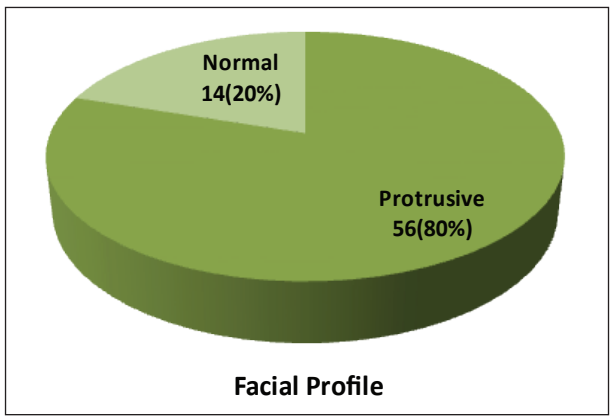

Fig. 9: Facial profile of the adult Santal population according to Steiner 'S' line.

DISCUSSION:

The present study is an attempt to establish a standard for the skeletal, dental and soft tissue pattern of Bangladeshi young Santal adults according to Steiner's analysis. The results obtained from the study were compared with the normal cephalometrics of Caucasians. A comparison was also made between Bangladeshi male and female young Santal adult subjects. Steiner's data of the Caucasian samples were taken from Steiner's[5] original article "Cephalometrics for you and me" published in the American Journal of Orthodontics in 1953.

Age distribution of the participants of the present study showed that over 80% were in their 3rd decade of life with median age of the participants being 37.0±6.1 (range: 18-40 years). The study revealed that the mean cephalometric parameters of the study subjects were significantly different in most of the parameters from those of the Caucasians[5] & findings of some other related previous studies.[6-8] Different angular measurements of Steiner's analysis were compared between sexes to find whether any of these angles were associated with sex. The analyses showed that no measurements were found significantly different between sexes.

Skeletal measurements:

The antero-posterior relationship of the jaws in relation to the Nasion was measured using SNA and ANB angles. The value of SNA and SNB angles, exhibited a lower value in Bangladeshi young Santal subjects than those in the Caucasians[5] and other studies.[6-9] It was indicated that the maxillary and mandibular apical bases were more orthognathic in the Bangladeshi Santal population. However, no statistically significant differences were found between male and female subjects. ANB angle revealed an antero-posterior relationship between the mandibular and maxillary apical bases relative to the cranial base. The value of this angle for Bangladeshi Santal population was relatively similar to the means reported by Steiner[5] and by other related studies.[6-9] without any significant difference. There was no significant difference in ANB angle between male and female Bangladeshi adult Santal subjects.

Mandibular plane angle to the cranial base (SN to GoGn angle) of Bangladeshi adult Santals was larger than that of the Steiner's norms and those of several other studies[6-8] (From this result, it is reasonably assumed that Bangladeshi Santal people have higher tilt of the mandibular planes than those studied in other population of this subcontinent. A study carried out by Mohammad et al[9] in Malaysia however, showed larger SN to GoGn angle than that found in the present study suggesting that Santal population have a more prominent horizontal growth than the Malaysian Malay people and more vertical growth than others. However, there was no significant difference between males and females in terms of SN to GoGn angle. Bangladeshi Santals showed a larger inclination of occlusal plane (SN to Op angle) than the Caucasians[5] and to others.[6-9] However, SN to Op angles obtained in Santals did not differ between males and females.

Dento-alveolar measurements:

A significantly greater UInc to NA (angular) was recorded in the present study than that in the Caucasians[5] and smaller than the findings of the other related studies.[6-9] LInc to NB (angular) also demonstrated a significantly greater figure in the present study than that in several other studies.[6-10] Interincisal angle showed that Bangladeshi Santals have smaller angle than that in other studies.[6-8] These findings along with a significantly smaller interincisal angle of Bangladeshi young Santals demonstrated a fact that the upper and lower incisors of Bangladeshi Tribal and non-tribal subjects were more protracted[6] (when compared with those of

other subjects.[8-10] As these two angular measurements (dentoalveolar measurements) were compared between male and female study subjects, no significant differences were found. Interincisal angle did not have any statistically significant difference between the sexes.

On Soft tissue measurement:

According to Steiner, the lips in well-balanced faces should touch a line extending from the soft tissue contour of the chin to the middle of an S formed by the lower border of nose. Lips located beyond and behind this line tend to be protrusive and retrusive, respectively. The present study, however, showed that among the study population, 80% of the facial profile were of protrusive type and the rest 20% were of normal type. Thus, this study suggests that the Bangladeshi young Santals have a high tendency to have protrusive lips.

CONCLUSION:

The study concluded that the Bangladeshi Santal population with well-balanced faces bear some fundamental variations in the craniofacial structure when compared to Steiner's norms of the Caucasians and from other population of this subcontinent. The results of the present study also support the idea that a single standard of facial esthetics should not be applied to all racial & ethnic groups. The following differences and similarities were demonstrated in the Bangladeshi Santal samples as compared to the Caucasian samples and others.

1. The maxillary and mandibular apical base in relation to the anterior cranial base was more anteriorly placed or prognathic.
2. The angular relationship of mandibular plane in relation to the cranial base plane (SN-GoGn angle) had higher tilt of the mandibular planes and more vertical growth than others and more prominent horizontal growth than the Malaysian Malay peoples.
3. The Bangladeshi Santal population had a protrusive dento-alveolar structure when compared to the Caucasians and to the other studies.

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