

Cephalometric norms of young adults of Bangladesh (Steiner's analysis)- preliminary report

Rizvi HM¹, Hossain MZ²

ABSTRACT

Cephalometric radiography is the most significant tool for improving taxonomy, communication and analysis of dento-facial variation, as in orthodontic evaluation and treatment, analysis of craniofacial morphology is essential. Steiner's analysis was used in this study; because its methods of assessing skeletal and dental morphology are very useful and valid providing maximal clinical information with the least number of measurements. The objective of this study was to describe the craniofacial pattern of Bangladeshi young adults and to compare it with accepted standards for the Caucasian population according to Steiner analysis. The study will also evaluate morphological differences between male and female Bangladeshi normal occlusion subjects. This is a cross-sectional observational study having both descriptive and analytical components. The study was conducted in Dhaka Dental College and Hospital on 52 Bangladeshi young adults (27 male and 25 females), aged 21-27 years, having balanced harmonious facial profiles, clinically acceptable occlusion with permanent dentition and no history of orthodontic treatment. Lateral cephalometric radiographs of these subjects were used for a series of cephalometric analyses. All the measurements were computed statistically. The study findings show that Bangladeshi subjects were more protrusive skeletally and dentally than Caucasians with a greater tendency towards bimaxillary protrusion. Furthermore, the mandibular plane angle was smaller than that of the Caucasians, suggesting more prominent horizontal growth pattern in the Bangladeshis. However, when the male and female Bangladeshi subjects were compared, no significant differences were found in cephalometric craniofacial parameters between both sexes. In view of the findings of this study, it is evident that there are some fundamental differences in the craniofacial structure between Bangladeshis and the Caucasians. 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: Cephalometric evaluation, population, Steiner analysis, racial group. (Ban J Orthod and Dentofac Orthop, Oct 2011; Vol-2, No. 1, p 11-15)

INTRODUCTION:

Populations differ in their character, size, growth, and shape. These differences are due to a complicated interaction of genetic and environmental factors.¹ Distinctions between races by geographical location, historical origins, culture, and language were usually subsumed into three major racial groups: Asiatic (or Mongoloid), Black (or Negroid), and White (or Caucasian).^{2,3} The classification into three groups gave each group its own characteristics, which in general serve to distinguish one from others. However, morphological and anthropological findings indicate not only did each racial group have its own standards⁴⁻⁷ but within the same race, each subgroup had its own standards.⁸⁻¹⁰ It is illogical to apply the standards of one racial group to another, or within the same race, or to apply the standards of one subgroup to another.¹¹⁻¹³

The cephalometric measurements may reduce subjectivity in the assessment of the aesthetically pleasing face, or indeed of the need for orthodontic and surgical intervention. Interventions on the jaws and facial skeleton can alter the facial appearance. With the increasing number of Bangladeshis seeking professional treatment from orthodontists, maxillofacial surgeons or plastic

and reconstructive surgeons, it has become apparent that there is the need to determine what constitutes a pleasing or normal face for the Bangladeshi population. Treatment plans and clinical procedure should not be freely switched without consideration of the racial group involved and without thorough understanding of the differences between races and their normal ranges.¹⁴ Cephalometric studies on different ethnic groups including those of Chan's¹⁵ on Chinese, Garcia's¹⁶ on Mexican Americans, Drummond's on Negroes⁵ and Park's¹⁷ on Korean adults have indicated that normal measurements of one group cannot be considered normal for other racial groups.

The first cephalometric study on the Bangladeshi population was done by Mahmood Sajedeem et al¹⁸ to obtain cephalometric norms of Bangladeshi children. He also expected a study for Bangladeshi adults.

Till date no study has been conducted on the adult population of Bangladesh. Under such background, the present study was designed for young adult population of Bangladesh in order to observe various hard tissues cephalometric values by means of Steiner's analysis with an aim of clinical application of the findings.

¹FCPS (Orthodontics), Dept of Orthodontics, Dhaka Dental College and Hospital. ²Professor and head, Dept. of Orthodontics, Dhaka Dental College and Hospital.

MATERIAL AND METHODS:

The material for this study consisted of standardized lateral cephalograms of 27 Bangladeshi young males and 25 young females. They were selected according to the following criteria. A normal acceptable and pleasing profile, 21-27 years of age, Angle Class I molar relationship with full complement of permanent dentition up to the 2nd molar in the proper intercuspal position.² No history of orthodontic treatment, no gross carious lesion or periodontal disease and no history of facial trauma.

The subject's head was positioned in the Pantos 16 xp roentgenographic cephalostat maintaining a target-film distance of 152.4 cms. The PSP plate which is enclosed in a light tight cassette was positioned parallel to the midsagittal plane of the subject such that the X-ray beam was directed perpendicular to it. The ear rods were used to stabilize the head in a vertical plane. The subject's head was positioned so that the Frankfort horizontal plane would be parallel to the floor. Each subject was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion during the exposure of the films and lips relaxed. X-ray films were exposed to an electric current of 61-85 Kvp and 4-10 mA with an exposure of 1.2 seconds.

The lateral cephalogram was traced upon an A4 size acetate paper with a 2B hard lead pencil over a well-illuminated viewing screen. Each cephalogram was traced twice at least at one week interval and the average measurement taken into account to minimize the error. The midline of the double contour bilateral structures was drawn to minimize error caused by head positioning. The linear measurements were recorded with a measuring scale up to a precision of 0.5mm. The angular measurements were recorded with a protractor up to a precision of 0.5 degree. A print out of results was then prepared for each tracing which reproduced the traced points according to Steiner analysis (Fig 1).

Written informed consent was obtained from each subject prior to taking cephalogram. Ethical clearance for the study was reviewed and approved by the National Research Ethics committee of Bangladesh Medical Research Council Ref: BMRC/NREC/2010-2013/901 dated: 28/10/10.

Statistical calculations performed included maximum and minimum values, mean and standard deviation for each parameter. Statistical comparisons were done by a Student's 't' test. The means were compared with the Steiner's norms for Caucasians. On the basis of these data, a complete chart of Steiner's analysis

was established for Bangladeshi young adult population. Means of the male and female subjects were also compared to find out sex differences. For a series of statistical treatment, a statistical package "STATA" (version 10.0 International version) was used.

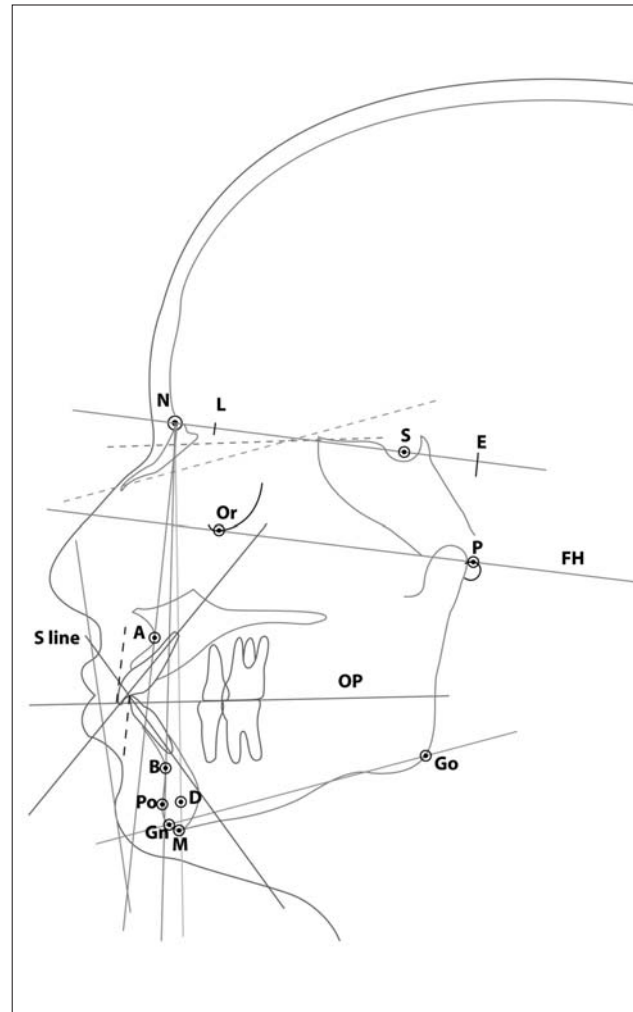


Figure 1 : Steiner's analysis with the reference points identified. 1. SNA; 2. SNB; 3. ANB; 4. SND; 5. U 1 to NA (mm); 6. U 1 to NA (angle); 7. L 1 to NB (mm); 8. L 1 to NB (angle); 9. Intercuspal angle 10. Op to SN; 11. GoGn to SN. 12. SE (mm) 13. SL (mm)

RESULTS:

Table I : Comparisons of the mean angular and linear measurements between male and female Bangladeshi subjects

Parameters	Male n=27			Female n=25			Significance	
	Average	S.D	S.E	Average	S.D	S.E	t-value	P-value
SNA	83.3	3.45	0.66	84.4	4.57	0.91	0.9544	0.3445
SNB	81.3	3.46	0.66	81.6	3.65	0.73	0.2340	0.8159
ANB	1.9	2.6	0.50	2.8	2.7	0.55	1.1162	0.2697
SND	79.2	3.39	0.65	79.3	3.85	0.77	0.1669	0.8681
U 1 to NA	30.2	6.23	1.19	29.4	7.09	1.41	0.4690	0.6411
U 1 to NA mm	8.0	2.42	0.46	7.9	1.94	0.38	0.2352	0.8150
L 1 to NB	29.2	7.73	1.48	32.2	8.32	1.66	1.3444	0.1849
L 1 to NB mm	7.8	3.38	0.65	8.21	2.77	0.55	0.4686	0.8631
Interincisal	119.2	10.62	2.04	116.1	10.03	2.00	1.0627	0.2930
SN to OP	12.8	3.37	0.64	13.3	4.42	0.61	0.8784	0.3839
SN to GoGn	25.0	6.34	1.22	26.6	6.3	1.26	0.9103	0.3670
SE mm	24.3	2.49	0.48	21.6	3.09	0.61	3.5367	0.0009*
SL mm	62.7	8.31	1.59	56.7	10.09	2.01	2.3583	0.0223*

*significance at level p<0.05

Table I showed, on comparison between male and female Bangladeshi subjects, that there was no significant difference between both sexes. However, both SL and SE distances depicted a statistically significant difference between male and female subjects with a confidence level of P <0.05.

SNA = Sella-Nasion-Point A angle; SNB = Sella-Nasion-Point B angle; ANB = Point A-Nasion-Point B angle; NA = Nasion-Point A plane; NB = Nasion-Point B plane; SN = Sella-Nasion plane; GoGn = Gonion-Gnathion ; NS = Nasion-Sella; OP = Occlusal plane; SND = Sella-Nasion-Point D angle

Table II : Statistical comparison between steiner's norm and Bangladeshi data

Parameters	Caucasian Norm	Bangladesh /Total N=52			Significance	
		Average	S.D	S.E	t-value	P-value
SNA	82	83.8	4.02	0.55	3.22	0.002*
SNB	80	81.5	3.52	0.48	3.07	0.003*
ANB	2	2.3	2.70	0.37	0.95	0.348
SND	76	79.3	3.58	0.49	6.64	0.001*
U 1 to NA	22	29.8	6.60	0.91	8.52	0.001*
U 1 to NA mm	4	8.0	2.18	0.30	13.23	0.001*
L 1 to NB	25	30.6	8.08	1.12	4.99	0.001*
L 1 to NB mm	4	8.0	3.08	0.42	9.36	0.001*
Interincisal	131	117.7	10.3	1.43	9.31	0.001*
SN to Op	14	13.3	4.42	0.61	1.14	0.258
SN to GoGn	32	25.8	6.33	0.87	7.06	0.001*
SE mm	22	23.0	3.10	0.43	2.32	0.024*
SL mm	51	59.8	9.61	1.33	6.60	0.001*

*significance at level p<0.05

Table II showed that the means of the Bangladeshi sample were significantly different in most measurement items from the means of the Caucasians. Only ANB and SN to OP angular measurements depicted no statistically significant difference between Bangladeshi and Caucasian subjects.

Figure 2 : Percentages of facial profile types in the present study according to steiner 'S' line

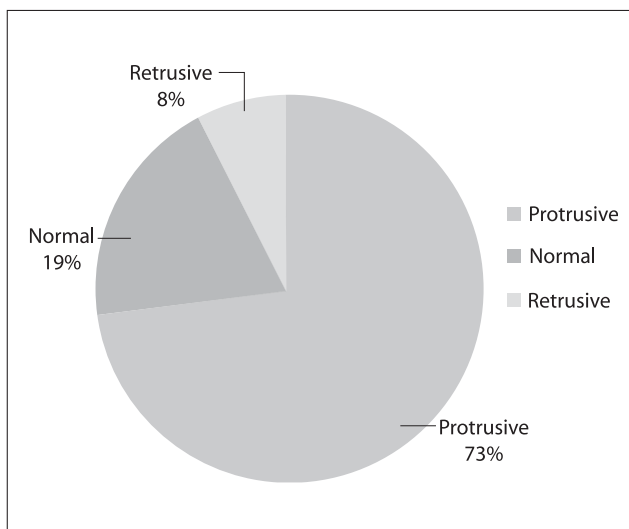


Figure 2 Shows the percentage of samples in the study having protrusive, normal and retrusive facial profile according to Steiner 'S' line.

DISCUSSION:

This study is an attempt to establish a norm or standard for the skeletal and dental pattern of Bangladeshi young adults according to Steiner's analysis. The results for the selected Bangladeshi population were compared with the norms of Caucasians. A comparison was also made between Bangladeshi male and female young adult subjects. Steiner's data on Caucasian samples were taken from Cecil C Steiner's original article "Cephalometrics for you and me" published in the American Journal of Orthodontics, October issue in the year 1953. The present study revealed that the means for the Bangladeshi sample were significantly different in most measurement items from the means of Caucasians. However, when comparison was made between Bangladeshi male and female subjects to find out any significant sex difference of cephalometric craniofacial parameters, there was no significant difference between both sexes.

Skeletal Measurements

Evaluating SNA and SNB angles, it is interesting to note that both exhibited a significantly greater value in Bangladeshi subjects than in the Caucasians. It indicated that the maxillary and mandibular apical bases were more prognathic ($P < 0.05$) in the Bangladeshi population when compared to the Caucasians (Table II). However, no statistically significant differences were found between male and female subjects (Table I).

ANB angle indicates an antero-posterior relationship between the mandibular and maxillary apical bases relative to the cranial base. The value of this angle for Bangladeshi population was relatively similar to the means reported by Steiner without any sig-

nificant difference (Table II). Thus, there was no significant difference in ANB angle between male and female Bangladeshi subjects (Table I).

The mean of SND angle was significantly larger in Bangladeshi subjects, indicating that the centre of mandibular symphysis is placed more forward ($P < 0.05$) than the Caucasians (Table II). When comparison was made between male and female Bangladeshi subjects, no significant difference was found between them (Table I).

Mandibular plane angle to the cranial base (SN to GoGn angle) of Bangladeshi adults was significantly smaller ($P < 0.001$) than that of the Steiner's norm (Table II). From this result, it may be a reasonable assumption that Bangladeshi people have a more prominent horizontal growth than the Caucasians. Meanwhile, there was no significant difference in the means between the males and females (Table I).

Bangladeshi population showed a smaller inclination of occlusal plane (SN to Op angle) than the Caucasians, although this difference was not statistically significant ($p = 0.258$) (Table II). This study also exhibited no significant difference in SN to Op angle between male and female subjects (Table I).

This study also revealed a wide divergence in the SE and SL distances in the Bangladeshi population. Mean of SE distance was significantly greater than that of Caucasians ($p < 0.05$) (Table II). This study also depicted that the SL distance in relation to the cranial base was significantly larger in Bangladeshi sample than the Caucasians ($P < 0.001$) (Table II). Both SL and SE distances depicted a statistically significant difference ($p < 0.05$) between male and female subjects with a smaller value in the female than in the male subject, suggesting that anteroposterior length of the mandible in relation to the cranial base was significantly larger in Bangladeshi males than in the females (Table I).

Dentoalveolar Measurements

U I to NA, (both angular and linear) recorded a significantly greater value in the Bangladeshi subjects. L I to NB (both angular and linear) also recorded a significantly greater value in the Bangladeshi subjects than in the American Caucasians (Table II). These findings along with a significantly smaller Interincisal angle (Table II) of the Bangladeshi young adults demonstrated a fact that the upper and lower incisors of Bangladeshi subjects were more procumbent and protracted when compared with that of Caucasian subjects. As far as the comparison between male and female subjects was concerned, U I to NA, (both angular and linear), L I to NB (both angular and linear) and Interincisal angle did not bear any statistically significant difference (Table I).

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.

This study, however, showed that among the study population, 73% of the Bangladeshi samples had protrusive lip, 19% had normal lip and only 8% had retrusive lip (Fig 2). Thus, this study suggests that the Bangladeshi young adults have a high tendency to have a protrusive lip profile compared to Caucasian samples.

CONCLUSION:

In line with the present findings, it is evident that in the Bangladeshi population, with well balanced faces, there are some fundamental variations in the craniofacial structure when compared to Steiner's norms in the Caucasians. These results would be beneficial for appropriate diagnosis and orthodontic treatment for Bangladeshi patients. The results of the present study also support the idea that a single standard of facial esthetics should not be applied to all racial and ethnic groups. The following differences and similarities were demonstrated in the Bangladeshi samples as compared to the Caucasian samples

1. The maxillary and mandibular apical base in relation to the anterior cranial base was more anteriorly placed or prognathic as compared to the Caucasian samples.
2. The angular relationship of mandibular plane in relation to the cranial base plane (SN-GoGn angle) was smaller which was suggestive of a more prominent horizontal growth pattern in Bangladeshis.
3. The Bangladeshi population had a protrusive dentoalveolar structure when compared to the Caucasians.
4. A wide divergence of the SE and SL distances were found in the Bangladeshi population when compared to the Caucasians.

To draw a decisive conclusion of the Steiner's analysis on Bangladeshi population for diagnosis, treatment planning and prognostic evaluation, further studies are needed with a larger study population after proper screening of facial types.

ACKNOWLEDGEMENT

I am grateful to Prof. Dr. Md. Zakir Hossain, Head, Department of Orthodontics and Dentofacial Orthopedics for his kind supervision and valueable time during this research work.

REFERENCES

1. Tanner JM. Foetus into man, physical growth from conception to maturity. 2nd ed, Castlemead Pub,1989..
2. Montague A. Man's most dangerous myth. The fallacy of Races, New York, Columbia University Press, 1942.
3. Coon CS, Garn SM, Bersill JB. Races: A study of the problems of race formation in man. Charles C.Thomas, Springfield, Illinois, 1950;65-71.
4. Miura Fujio, Inone N, and Suzuki K. Cephalometric standards for Japanese according to the Steiner analysis. American Journal ofOrthodontics, 1965, 51:288-295,
5. Drummond RA. A determination of cephalometric norms for the Negro race. Am J Orthod. 1968; 54:670-82.
6. Guo MK. Cephalometric standards of Steiner analysis established on Chinese children. J Formosa Med Assoc. 1971;70:97-102.
7. Baccon W, Ciradin P, Turlot J. A comparison of cephalometric norms for the African Bantu and Caucasoid population. Europ J Orthod. 1983;5:223-24.
8. Burstone CJ. The integumental profile. Am J Orthod. 1958;44:1-25.
9. Holdaway RA. A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Am J Orthod. 1983;84:1-28
10. Nashashibi IA, Shaikh HS, Sarhan OA. Cephalometric norms for Saudi boys. The Saudi Dent J.1990;2:52-57.
11. Cotton WN, Takano WS, Wong WW, et al. Downs analysis applied to three ethnic groups. Angle Orthod. 1951;21:213-20.
12. Kowaliski CJ, Nasjleti C, Walker GF. Differential diagnosis of American adult male black and white populations using Steiner analysis. Angle Orthod. 1974; 44:346-50.
13. Houston WJB, Tully WJ. A textbook of orthodontics. Bristol Wright 1986;188-91.
14. Nasser M. Al-Jasser, Saudi Medical Journal 2000; Vol. 21 (8): 746-750
15. Chan GKH. Cephalometric Appraisal of The Chinese (Cantonese) .Am J Orthod. 1972. 61, 279-285.
16. Garcia CJ. Cephalometric evaluation of Mexican Americans using the Downs and steiner analysis. Am J Orthod; 1975, 68, 67-74.
17. In-Chool Park Shinsa-Dong, Douglas Bowman and Lewie Klapper. A cephalometric study of of Korean adults. Am J Orthod, 1989.;96, 54-59.
18. Sajedeem M, Rizvi HM and Hossain MZ, Estimation of Cephalometric Norm for Bangladeshi Children (Steiner method). Bangladesh journal of Orthodontics and Dentofacial Orthopedics, 2010.vol 1(1), 1-4.

Correspondence

Dr. Hasan Md. Rizvi, BDS, FCPS

Dept. of Orthodontics and Dentofacial Orthopedics

Dhaka Dental College and Hospital

Mirpur- 14, Dhaka- 1206

Mobile : +8801710918222, E-mail : hasanriz2008@yahoo.com