Cephalometric evaluation of the Assamese young adults using Tweed's analysis

Poonam Majumder[1,*], Manoj Sharma[2], Heeralal Chokotiya[3], Mahasweta Das Gupta[4], N. Ibemcha Chanu[5]

[1]Private Practitioner, Dept. of Orthodontics, Private Practice, Agra, Uttar Pradesh, [2]Medical Officer, Government of Rajasthan, [3]Senior Lecturer, Dept. of Orthodontics, Mansarovar Dental College, Bhopal, Madhya Pradesh, [4,5]Post Graduate Student, Regional Dental College, Guwahati, Assam, India

*Corresponding Author:
Email: majumderpoonam87@gmail.com

Abstract

The cephalometric norms of different ethnic and racial groups established in various studies show that normal measurements for one group are not necessarily normal for another group; each racial group must be treated according to its own characteristics. The materials used in this study consist of cephalometric radiographs of 50 subjects (23 males, 27 females) from Assamese ethnic background. The head films were traced on A4 size acetate matt paper using 3Hb pencil and Tweeds cephalometric analysis was done. Three angular parameters Frankfort mandibular plane angle (FMA), Frankfort Mandibular Incisal Angle (FMIA), Incisor mandibular plane angle (IMPA) for the Assamese population, were measured and found to be 25.4, 56.6 and 98.06 degree respectively. There was no clinical significant different between Assamese male and female but there is highly significant among the Assamese and Caucasian parametric values of Tweeds diagnostic triangle.

Keywords: Tweeds Cephalometric analysis, Racial norms, Assamese population.

Introduction

Radiographic cephalometry has been used extensively to study facial form and develop norms to aid in orthodontic diagnosis and treatment planning. It is also used to assess treatment progress and craniofacial growth, to predict growth for individual patients, and for other tasks in orthodontic research.

Many cephalometric analyses have been made to establish norms for ideal facial proportions and occlusion, presenting average measurements of skeletal or dental patterns and their range.[1]

The cephalometric norms of different ethnic and racial groups established in various studies show that normal measurements for one group are not necessarily normal for another group; each racial group must be treated according to its own characteristics. A number of standards have been developed for various racial and ethnic groups. It is important to compare a patient's cephalometric findings with the norms for his or her ethnic group for an accurate diagnostic evaluation, while considering his or her treatment goals and needs.

Cephalometric studies of different ethnic groups are now available, including Downs study of Caucasians[1], Suh's study of Koreans,[2] Mitani's study of Japanese,[3] Chan's study of Chinese,[4] Nanda's study of North Indians,[5] Garcia's study' of Mexican Americans,[6] Drummond's study of Negroes[7] etc.

Tweed developed this analysis as an aid to treatment planning, anchorage of three planes that form a diagnostic triangle. The planes used were Frankfort horizontal plane, mandibular plane and long axis of lower incisor. The first angle is Frankfort mandubular incisal angle (FMIA). He established a standard of 68 degrees for individuals with a Frankfort mandibular angle (FMA) of 22 to 28 degrees. The standard should be 65 degrees if the FMA is 30 degrees and above, and

FMIA increase if the FMA is lower. Tweed believed that this value was significant in establishing balance and harmony of the lower face. The second measurement was FMA. This angle is probably the most significant value for skeletal analysis because it defines the direction of the lower face growth both in the horizontal and vertical dimension. The standard or normal range of 22-28 degrees projects a skeletal pattern with a normal growth direction. An FMA greater than the normal range indicates excessive vertical growth, and FMA less than the normal range indicates deficient vertical growth. The third and most important measurement is Incisal mandibular plane angle (IMPA). It is the angle between the axial inclinations of incisor in relation to the mandibular plane. The standard of 88 degrees indicates an upright position of lower incisors. With a normal FMA this position reflects optimum balance and harmony of the lower facial profile. If the FMA is above normal, the orthodontist must compensate by further uprighting the mandibular incisors. If the FMA is below the normal range, compensation can be made by leaving the mandibular incisors at their pretreatment position or by positioning them more to the labial. Labial inclination of the mandibular incisors is generally limited to 94 degrees in patients with normal muscular balance because of tissue health and stability.[8,9]

P Bhattarai and RM Shrestha conducted a study on Nepalese population to establish the Tweed's norms for Nepalese people, compare the values between the Nepalese male and female samples as well as to compare with the Caucasians.[10] The study concluded there was no clinical significant different between Nepalese male and female but there is highly significant among Nepalese and Caucasian. Manan Bharat Atit, Sonali Vijay Deshmukh et al concluded in their study

that the cephalometric norms for Steiner, Tweed, Ricketts and McNamara cephalometric analysis of the Maratha population differed significantly from the Caucasian population. Comparison of our sample with the other ethnic group reaffirmed the need to develop separate standards for different populations.[11] Therefore, it is legitimate and important for those undertaking orthodontic treatment for patients of Maratha ethnicity to use cephalometric norms for Maratha ethnic population. A similar study conducted by Nabanita Baruah, Mitali Bora, on the Assamese population to establish skeletal & dental parameters for Assamese young adults using Steiner's analysis, concluded that in comparison to the Caucasian samples the Assamese samples were more protrusive skeletally and dentally with a greater tendency towards bimaxillary protrusion.[12] These differences indicate that fundamental variation exists in the craniofacial structure of Assamese and the Caucasians. The results of the study support the fact that norms and standards of one racial group could not be used without modification for other racial group and each different racial group would have to be treated according to its individual characteristics.

Till date there is no recorded data on Assamese value of Tweed's analysis. This paper will establish the standard for the Assamese people. The purpose of this paper is to establish the Tweed's norms for Assamese, compare the values between the Assamese male and female samples as well as to compare with the Caucasians and other races.

Materials and Methods

The materials used in this study consist of cephalometric radiographs of 50 subjects (23 males, 27 females) from Assamese ethnic background. The criteria for the selection of the sample were:
1. Subjects of Assamese origin aged 18 to 30 years
2. Angle Class I molar relationship
3. Acceptable profile.
4. No history of previous orthodontic treatment, gross carious lesion, periodontal disease.
5. No history of facial trauma.
6. Subjects who have mild crowding or spacing (up to 3mm per jaw), with overjet and overbite up to 4mm.

Materials
1. Computed Radiography (CR) system – Regius Model 190 & Drypro-793. (Konika) Dental X-ray Unit with Cephalometry.
2. CR cassette –Advapex Panaromic System 8 x 10 inches
3. X-ray illuminator or a View box on a tracing table with soft light.
4. .003 mm Acetate matt tracing paper.
5. Geometry box set containing protractor, set squares, scale, 0.3mm 3Hb pencil, eraser etc.

The subjects were positioned with their spines erect and FH plane parallel to the floor. The head was immobilized in the cephalostat using ear rods and the Nasion holder. The subject was requested to look in to the reflection of their eyes in a mirror located 200cm ahead. The object source distance was 5 feet. A voltage of 80 Kvp and a current of 10 mA was used to obtain the lateral head film (8x10 inches film). The exposure time was 1 second.

The head films were traced on A4 size acetate matt paper using 3Hb pencil. The tracing paper is mounted on the radiographic films and secured with minimum four paper clips.

Three orientation crosses are marked on the cephalogram; two within cranium and one on the cervical vertebrae with a sharp pointed tool. These orientation crosses are transferred to the tracing paper. The transfer guide helps to correctly orient the cephalogram. The sample's name, age and serial number is written on the tracing paper for future reference.

The following cephalometric parameters were used to do the Tweeds analysis:
1. **Frankfort Mandibular plane Angle (FMA):** The Frankfort mandibular plane angle is formed by the intersection of the Frankfort horizontal plane with the mandibular plane. The mean value is 25°.
2. **Frankfort Mandibular Incisal Angle (FMIA):** The Frankfort mandibular incisor angle is obtained by the intersection of the long axis of the lower incisor with the Frankfort horizontal plane. The mean value is 65°.
3. **Incisor Mandibular Plane Angle (IMPA):** The incisor mandibular plane angle is constructed by drawing a line through the apex and insical edge of the mandibular central incisor, extending it to intercept the mandibular plane. The mean value is 90°.

The tracings were analyzed using angular measurements according to Tweed's analysis. The angular measurements were done to an accuracy of 0.5 degrees. All essential landmarks were identified and traced thrice and the average of three values was considered. The measurement error was determined by re-measuring the cephalometric parameters.

The mean, standard deviation, minimum and maximum values of each measurement were tabulated and statistical evaluation was done. The student 't' test was used to determine the significance when the sample values were compared to other groups.
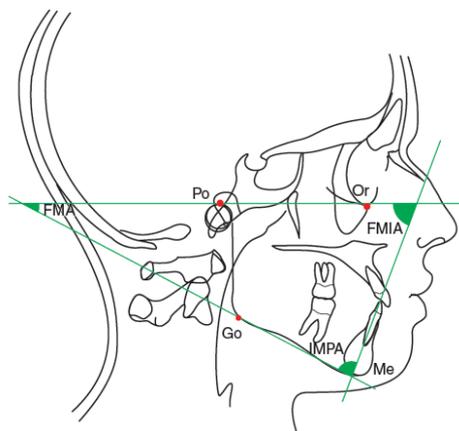
Fig. 1: Landmarks and planes used in tweeds analysis

Fig. 2: Standardised lateral cephelogram of assamese population

Results

Descriptive statistcs like mean standard deviation, standard error, minimum, maximum, and the level of statistical significance are analysed using the student 't' test. The results of the 't' test showed that the Assamese mean values of both FMIA, IMPA differed statistically significantly (p<0.001), FMPA however did not differ significantly when compared to the mean values of the Caucasians.

Various levels of statistically significant difference were found when the measured parameters of the Assamese population were compared to the other races like Nepalese, Mongoloids, Koreans, Iranians, North Indians, Marathas.

When comparison was between the Assamese males and females, statistically significant difference (P<0.05) were found only in the mean value of FMPA.

Table 1: Descriptive statistics for the cephalometric measurements for adult Assamese female in this study

Parameter	Mean	SD	SE	Minimum	Maximum
FMA	26.54	3.70	0.70	18	34
FMIA	56.61	6.30	1.19	45	68
IMPA	97.04	6.93	1.31	85	111

Table 2: Descriptive statistics for the cephalometric measurements for adult Assamese male in this study

| Parameter	Mean	SD	SE	Minimum	Maximum
FMA	23.95	5.12	1.09	15	35
FMIA	56.68	7.53	1.61	40	70
IMPA	99.36	6.25	1.33	85	110

Table 3: Descriptive statistics for the cephalometric measurements for combined males and females Assamese population in this study

| Parameter	Mean	SD	SE
FMA	25.4	4.52	0.64
FMIA	56.64	6.79	0.96
IMPA	98.06	6.68	0.94

Table 4: Comparative statistics between tweeds cephalometric norms of Assamese and caucasian population.

Parameter	Mean (Assamese)	SD	SE	p value
FMA	25.4	4.5243	0.6398	0.1659
FMIA	56.64	6.7929	0.9607	<.0001
IMPA	98.06	6.6767	0.9442	<.0001

Graph 1: Comparative statistics between Tweeds cephalometric norms of Assamese and Caucasian population
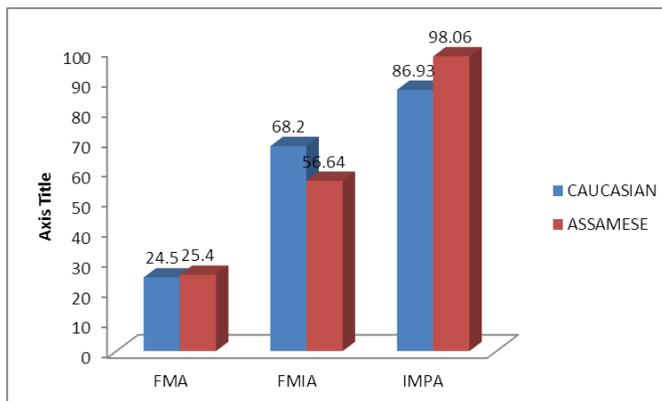
Graph 2: Comparative graph of Tweeds cephalometric norms of Assamese, Iranian, Mongoloid, Korean, Nepalese
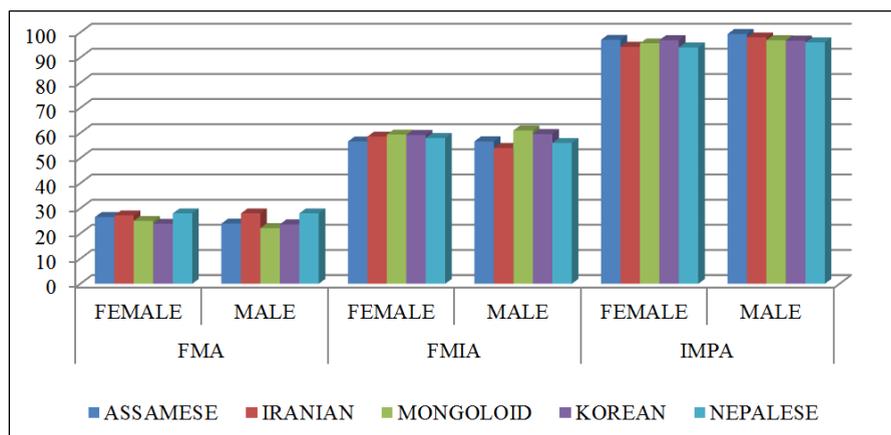
Discussion

The improvement of facial esthetics has rapidly become one of the desirable objectives of orthodontic treatment, with that the concept of normal has become indispensable to an orthodontist. Normal was defined by Tweed as "The balance and harmony of proportions considered by the majority of us as most pleasing in the human face."[8]

However, since soft tissue, dental and skeletal structures exhibit different pattern for different races, it has become relevant to define norms for various ethnic groups of population for successful diagnosis and treatment planning. An attempt was made to establish the Tweeds cephalometric norms of Assamese population by studying the facial features and also to compare the cephalometric norms of Assamese males and females.

The mean value of Frankfort mandibular plane angle for the Assamese male is 23.95° with standard deviation of 5.12 and for the female is 26.54° with standard deviation of 3.70. The mean value of Frankfort Incisor Plane Angle for the Assamese male is 56.68° with standard deviation of 7.53 and for the female is 56.61° with standard deviation of 6.30. The mean value of Incisor mandibular plane angle for the Assamese male is 99.36° with standard deviation of 6.25 and for the female is 97.04° with standard deviation of 6.93.

Frankfort Mandibular Plane Angle: There was no significant difference between the male and female cephalometric values except the mean value of Frankfort mandibular plane angle. The females have a significantly (p<0.05) higher mean value of Frankfort Mandibular plane angle as compared to the males, which indicate more vertical mandibular growth pattern

of the female. The mean value of Frankfort mandibular plane angle for the Assamese is 25.4° with standard deviation of 4.52. When compared to the Caucasian norms no statistically significant difference was found (p>0.05).

Incisor Mandibular Plane Angle: There is a highly statistically significant difference (p<0.0001) in the mean value of Incisor mandibular plane angle for the combined Assamese group i.e. 98.06° when compared to the Caucasian mean value of Incisor mandibular plane angle i.e. 86.93°. This indicates that the Assamese populations have slightly more proclined lower incisors in relation to the mandibular plane as compared to the Caucasians. However the mean value of the Incisor mandibular plane angle of the Assamese still falls within the Tweed's range of 76-99 degrees, although not as upright as that of the Caucasian samples of Tweed.

Frankfort Mandibular Incisor Angle: The mean value of Frankfort mandibular incisor angle for the Assamese is 56.64° with standard deviation of 6.79. When compared to the Caucasian norms statistically significant difference was found (p<0.0001).This difference is attributed to the more proclined lower incisor of the Assamese population which is also evident from the higher mean value of the Incisor mandibular plane angle of the Assamese population.

Conclusion

From the present study following conclusions were made:

The mean value of Frankfort mandibular plane angle for the Assamese population is 235.4° with standard deviation of 4.52. The mean value of Frankfort mandibular incisor angle for the Assamese population is 56.64° with standard deviation of 6.79. The mean value of Incisor mandibular plane angle for the Assamese population is 98.06° with standard deviation of 6.67. The Frankfort mandibular plane angle for the Assamese population is similar to that of Tweeds value for the Caucasians. The Incisor mandibular plane angle of the Assamese population was significantly higher when compared to the Tweeds value for the Caucasians, indicating more proclined lower incisors of the Assamese population in relation to their mandibular plane. The Frankfort mandibular incisor angle of the Assamese population was significantly lower when compared to the Tweeds value for the Caucasians, indicating more proclined lower incisors of the Assamese population in relation to their mandibular plane.

When the mean values of Tweeds cephalometric analysis of the Assamese population was compared to other races like Nepalese, Mongoloid, Korean, Iranian, North Indian, Maratha significant differences were found in the parameters. There was no significant difference between the Assamese male and female cephalometric values except the mean value of

Frankfort mandibular plane angle. The females have a significantly higher mean value of Frankfort mandibular plane angle as compared to the males, which indicate more vertical mandibular growth pattern of the female.

Most cephalometric analyses are designed for orthodontic diagnosis and treatment planning. It seems to be inappropriate to depend on Caucasian norms for the assessment of orthodontic patient because any two different population groups have several dissimilarities in their dentofacial structures, as is evident from the present study.

References

1. Willian B. Downs Downs WB. The role of cephalometrics in orthodontic case analysis and diagnosis. *Am J Orthod* 1952;38:162–82.
2. Suh C-H. Roentgenographic cephalometric study on the teeth and skull. *J Korean Modem Med* 1967;6:515-27.
3. Mitani S. A roentgenocephalometric study of seventeen-year old Japanese using several analyses [Master's thesis]. Loyola University School of Dentistry, 1980.
4. Chan GH.K. A Cephalometric appraisal of the Chinese (Cantonese). *Am J Orthod* 1975;61:279-85.
5. R. Nanda, R.S. Nanda. Cephalometric study of the Dentofacial complex of the North Indians. *The Angle Orthodontist* 1969;39:1.
6. Garcia CJ. Cephalometric evaluation of Mexican Americans using the Downs and Steiner analyses. *Am J Orthod* 1975;68:67-14.
7. Drummond R A. A determination of cephalometric norms for Negro race. *Am J Orthod* 1968;54:670-82.
8. Charles H. Tweed. The diagnostic facial triangle in the control of treatment objectives. *Am. J. Orthodontics* June 1969; vol. 55 no. 6.
9. Charles H. Tweed. The Frankfort-mandibular plane angle in Orthodontic Diagnosis, Classification, Treatment. *Am Journ of Orthod* Vol. 32 April, 1946 No. 4,32:175-221.
10. P Bhattarai and RM Shrestha. Tweeds analysis of Nepalese people. *Nepal Med Coll J* 2011;13(2):103-106.
11. Manan Bharat Atit, Sonali Vijay Deshmukh, Jayesh Rahalkar,Vijay Subramanian, Charudatt Naik, Milind Darda. Mean values of Steiner, Tweed, Ricketts and McNamara analysis in Maratha ethnic population: A cephalometric study. *APOS Trends in Orthodontics* | September 2013 | Vol 3 | Issue 5.
12. Nabanita Baruah, Mitali Bora. "Cephalometric evaluation based on Steiners Analysis on young adults of Assam". *The Journal of Indian Orthodontic Society*. Volume 43, Number 1 January-March, 2009.