Cephalometric evaluation of young South Indian adults using Tweed's analysis

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Abstract-The aim of the present study was to establish the Tweed's parameters for South Indian population. A study of 70 South Indian young adults (35 males and 35 females) within age range of 18-28 years with acceptable profile and occlusion were selected for the study and assessed using Tweed's analysis. The three angular parameters of Tweed's analysis, Frankfort Mandibular plane angle (FMA), Frankfort Mandibular Incisal Angle (FMIA) and Incisor Mandibular plane angle (IMPA) for the South Indian population was measured and found to be 23.1, 57.1 and 99.8 degree respectively.

Significant difference was seen among young adult South Indian population and Caucasian values of Tweeds diagnostic triangle. There was a difference in between the mean values of FMA and FMIA among male and female South Indian population and the IMPA did not show any difference.

Keywords: Adult population, Cephalometric norms, South Indian population, Tweeds Cephalometric analysis

Introduction

Cephalometry is a measurement of the head from shadows of bony and soft tissue landmarks on the Roentgenographic image. It was spawned by the classic work of **Broadbent** in United States and **Hofrathin** Germany. Cephalometrics was first introduced as a tool to study craniofacial growth and development. Later on, it was used to study about the facial forms and it outlined the objectives of treatment in orthodontics by extending its arena with cephalometric norms development. The introduction of **Cephalometer** then started avenues for creation of cephalometric analysis guiding in clinical diagnosis and treatment planning. Soon, *Cephalogram became an indispensable weapon for the same and helped to attain correct diagnosis, prognostic evaluation and comparative studies*. [1-5]

Tweed developed an analysis as an aid to treatment planning, anchorage preparation and determining the prognosis of orthodontic cases.

Tweed's Analysis-

The analysis consists of three planes which forms three angles: [6]

1. Frankfort horizontal plane- Is established by connecting a point 4.5 mm, above geometric centre of the ear rod and an orbitale point midway between the left and right lower borders of the orbits.

2. The Mandibular plane-Is drawn along the lower border of the mandible and was extended posteriorly to connect with Frankfort plane. Anteriorly this plane connected menton, and posteriorly it bisects the distance between the right and left lower borders of the mandible in the region of the gonial angle.

3. The long axis of lower incisor. The third leg of the triangle is made by extending the long axis of the mandibular central incisor downward to the mandibular plane and upward to the Frankfort plane.

Thus, the angles FMA, IMPA, and FMIA are formed The conclusions that he drew from these studies were that if the orthodontist is to attain facial aesthetics and dentures similar to those found in non-orthodontic normal persons, he must position the mandibular incisors within this normal range of 90 degrees minus or plus 15 degrees.[7,8]

The **FMA** is probably the most significant value for skeletal analysis because it defines the direction of lower facial growth in both the horizontal and vertical dimensions. The standard on normal range of 22° to 28° for this value projects a skeletal pattern with normal growth direction. An FMA greater than the normal range indicates excessive vertical growth and an FMA less than the normal range indicates deficient vertical growth.[9]

The importance of the size of the **FMIA,** in creating satisfactory facial aesthetics as a result of orthodontic treatment.[10]

The **IMPA** defines the axial inclination of the mandibular incisor in relation to the mandibular plane. It is a good guide to use in maintaining or positioning these teeth in their relationship to basal bone.

The current norms of diagnostic triangle given by tweeds followed by most, were done among Caucasians. So this study was conducted to establish Tweed's norms for South Indian young adults, and to compare the values of South Indian population to Caucasians norms.

Null hypotheses

Following is the *null hypotheses* of this study:

(1) There is no difference in between Tweeds diagnostic triangle value among Caucasians and South Indian population (2) There is no difference in between Tweeds diagnostic triangle value among male and female South Indian population.

Materials and Methods

In this Study a total of 70 lateral Cephalometric radiographs of Tamil Nadu young adults (35 females and 35 males; aged18–28 years) with balanced and acceptable facial profiles, minimum overbite and overjet , Class I skeletal and dental relationships and no previous orthodontic treatment were traced and analyzed manually at Department of Orthodontics Sathyabama Dental college and Hospital, chennai. The study protocol was approved by the Institutional Review Board of Sathyabama Dental college and Hospital.

The subject's head was positioned in the roentgenographic cephalostat maintaining a target-film distance of 5feet or 152.4 cm. 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 Natural Head position would be parallel to the floor and was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion during the exposure of the films. The kilo voltage used for X-ray exposure was 61 to 85kVp.Milliampere was 4 to 10 mA and time required for the exposure was 2.5 seconds.

The lateral cephalogram were traced upon an A4 size acetate matt tracing sheet with a lead pencil over a well-illuminated viewing screen. Each cephalogram was traced twice and the average measurement taken into account to minimize the error. The angular measurements were recorded with a protractor up to 0.05mm correction.

Landmarks used in the Study
The following ***three planes*** that form Tweed's diagnostic triangle were used.
1. Frankfort horizontal plane: Line joining from external auditory meatus to orbitale
2. Mandibular plane: Line passing tangent to the lower border of mandible
3. Long axis of lower incisor
The following ***three angles*** formed in Tweed's triangle was measured
1. Frankfort Mandibular plane Angle (FMA),
2. Frankfort Mandibular Incisal Angle (FMIA),
3. Incisor Mandibular Plane Angle (IMPA)

Statistics
The data was tabulated and computed using SPSS software version 21.0. Statistical calculations performed included mean, standard deviation, standard error and Student's t-test for each parameter. Statistical comparisons were done by the t-test, p-value <0.001 was considered to be significant.

Results
Comparisons of Tweed's parameters of male and female South Indian subjects (Table 1) (Figure1)

Table-1Comparisons of Tweed's parameters of male and female South Indian subjects

Parameters	Male (n=35)	Female (n=35)	t value	p value
FMA	21 (2.5)	24 (4.7)	2.13	0.04*
FMIA	58.5 (9.9)	56.1 (8.4)	1.18	0.24
IMPA	99.7 (10.9)	99.8 (7.5)	0.03	0.97

*Date are presented Mean and Standard deviation. * p<0.05 Statistically significant.*

Figure 1Bar diagram Comparing of Facial Triangle—male and female South Indian subjects
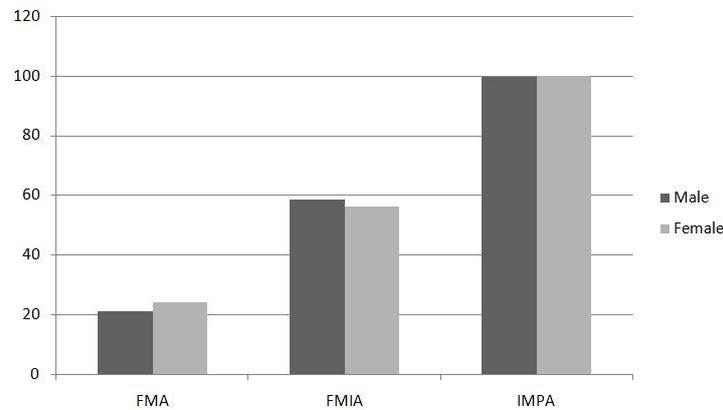
Comparative statistical evaluation of Tweed's norm and the South Indian subjects (Table 2)

Table-2 Comparative statistical evaluation of Tweed's norm and the South Indian subjects

Parameters	Caucasian norm	Mean (SD) (N=70)	t value	p value
FMA	25	23.1 (5.2)	3.31	0.001*
FMIA	65	57.1 (9.1)	7.78	<0.0001*
IMPA	90	99.4 (9.0)	9.72	<0.0001*

*Date are presented Mean and Standard deviation. * p<0.05 Statistically significant.*

Comparison of cephalometric values of present South Indian subjects with Caucasians, Nepalese and, Bangladeshi population.(Table 3)

Table-3Comparison of cephalometric values of present South Indian subjects with Caucasians, Nepalese and, Bangladeshi population

Parameters	Caucasian norm	Present Study (N=70)	Nepalese norms P Bhattarai et al (N=100)	Bangladeshi norm Hasan Md Rizvi et al (N=89)
FMA	25	23.1 (5.2)	28	24.52
FMIA	65	57.1 (9.1)	57	54.60
IMPA	90	99.4 (9.0)	95	100.88

Comparison of cephalometric values of present South Indian subjects with Caucasians, Bengali and Assamese population.(Table 4).

Table-4 Comparison of cephalometric values of present South Indian subjects with Caucasians, Bengali and Assamese population.

Parameters	Caucasian norm	Present Study (N=70)	Bengali L Kumari et al (N=50)	Assamese, PoonamMajumder et al. (N=50)
FMA	25	23.1 (5.2)	25.84	25.4
FMIA	65	57.1 (9.1)	59.11	56.64
IMPA	90	99.4 (9.0)	95.01	98.06

Discussion

Comparison between male and female South Indian population

Statistical difference was found in between the South Indian male and female samples
FMA- **The mean FMA of south Indian males is 21^0 and for females is 24^0,which is states that males have a comparatively lower FMA than females which reveals that south Indian males has a horizontal growth pattern whereas the female subjects shows an average growth pattern**

FMIA-**Mean FMIA of South Indian male samples were 58.5^0 and for females is 56.1^0.The mean difference of 2.4^0suggests that the South Indian females tend to have a upright lower incisor when compared to the South Indian males**

IMPA- **The mean IMPA values of south Indian males is (99.7^0) and for females is (99.8^0) which conveys that there is no difference in IMPA between the male and female subjects.**

Comparison between Caucasian and South Indian population:

FMA- The South Indian sample presented a mean FMA of 23.1^0 which was lesser than that of the Caucasian mean value of 25^0.The South Indian sample suggests of horizontal growth pattern when compared to the Caucasian norms.
FMIA- The South Indian male samples presented a mean FMIA of 57.1^0which was lesser than that of the Caucasian mean value of 65^0.The mean difference of 7.9^0 suggests that the South Indian subjects tend to have a proclined lower incisor when compared to Caucasian norms.
IMPA- The South Indian samples presented a mean IMPA of 99.4^0,compared with Tweed's Caucasian norms, the South Indian population showed an increase of 9.4^0 suggesting that the South Indians have more proclined lower incisors than the Caucasian group.

Comparison between South Indians, Nepalese and Bangladeshi subjects

FMA- the South Indian sample presented a mean FMA (23.1^0) which suggest of horizontal growth pattern when compared to the Caucasian norms. The Nepalese sample presented a mean FMA(28^0) which was higher than the present study and Caucasian norms, suggestive of vertical growth pattern among Nepalese subjects. The Bangladeshi sample presented a mean FMA(24.52^0) which was higher than the present study and similar to the Caucasian norms, suggestive of average growth pattern among Bangladeshi subjects.

FMIA- the South Indian male samples presented a mean FMIA (57.1^0) which was lesser than that of the Caucasian sample (65^0), suggests that the South Indian subjects tend to have a proclined lower incisor when compared to Caucasian norms. The Nepalese sample presented a mean FMIA (57^0) which was similar to the present study and lesser than the Caucasian norms, suggestive of proclined lower incisor among Nepalese subjects. The Bangladeshi sample presented a mean FMIA(54.60^0) which was lesser than the present study and Caucasian norms, suggestive of proclined lower incisor among Bangladeshi subjects.

IMPA- The South Indian samples presented a mean IMPA (99.4^0).IMPA compared with Tweed's Caucasian norms suggesting that the South Indians have more proclined lower incisors than the Caucasian group .The Nepalese sample presented a mean IMPA(95^0) which was Lesser than the present study and higher than the Caucasian norms, suggestive of proclined lower incisor among Nepalese subjects. The Bangladeshi sample presented a mean IMPA(100.88^0) which was higher than the present study and Caucasian norms, suggestive of proclined lower incisor among Bangladeshi subjects.[12,13]

Comparison between South Indians, Bengali and Assamese subjects

FMA- The South Indian sample presented a mean FMA (23.1^0) which suggests of horizontal growth pattern when compared to the Caucasian norms. The Bengali sample presented a mean FMA(25.84^0) which was higher than the present study and similar to the Caucasian norms, suggestive of Average growth pattern among Bengali subjects. The Assamese sample presented a mean FMA(25.4^0) which was higher than the present study and similar to the Caucasian norms, suggestive of average growth pattern among Bangladeshi subjects.

FMIA- The South Indian male samples presented a mean FMIA (57.1^0) which was lesser than that of the Caucasian sample (65^0), suggests that the South Indian subjects tend to have a proclined lower incisor when compared to Caucasian norms. The Bengali sample presented a mean FMIA(59.11^0) which was higher than the present study and lesser than the Caucasian norms, suggestive of proclined lower incisor among Bengali subjects. The Assamese sample presented a mean FMIA(56.64^0) which was similar to the present study and lesser than the Caucasian norms, suggestive of proclined lower incisor among Assamese subjects.

IMPA- The South Indian samples presented a mean IMPA (99.4^0). IMPA compared with Tweed's Caucasian norms suggesting that the South Indians have more proclined lower incisors than the Caucasian group. The Bengali sample presented a mean IMPA(95.01^0) which was Lesser than the present study and higher than the Caucasian norms, suggestive of proclined lower incisor among

Bengali subjects. The Assamese sample presented a mean IMPA(98.06^{0}) which was similar to the present study and higher than the Caucasian norms, suggestive of proclined lower incisor among Assamese subjects.[11,14]

The result of the above study rejects the null hypothesis; the study revealed that there is difference in between the mean diagnostic triangle values of Caucasians and South Indian population. The study also revealed that there is a difference in-between the mean diagnostic triangle value among the male and female South Indian population.

Conclusion

As discussed, the study concluded with 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. The present study revealed that there is significant difference among South Indian and Caucasian in Tweed's value, the mean value of South Indian Tweed's analysis were FMA (23.1^{0}), FMIA (57.1^{0}) and IMPA (99.4^{0}).There was a difference in the mean FMA, FMIA values among the male and female South Indian subjects, the mean IMPA value did not show much difference among male and female South Indian population.

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