

Cephalometric Norms-based on Steiner's Analysis on Young Adults of Tamil Nadu Population

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Abstract

Aim-The purpose of the study was to establish skeletal and dental parameters for Tamil Nadu young adults using Steiner's analysis and comparing it with Caucasians, as well as other racial groups. **Materials & Methods-** A study of 70 south Indian young adults (35 male and 35 female) within the age range of 18-28 years with acceptable profile and occlusion was selected for the study and assessed using Steiner's analysis. **Results-** The Tamil Nadu population showed a more skeletally protrusive maxilla, dentally proclined and forwardly positioned upper and lower incisor, it also exhibited a horizontal growth pattern when compared with Caucasians norms. The Tamil Nadu male samples reported a protrusive skeletal and dental pattern when compared to female samples.

Conclusion-The result of the study supports the fact that the norms and standards of one racial group could not be used without modification for other racial groups and each different racial group would have to be treated according to its individual characteristics. A case of malocclusion needs to be treated based on the individual merits and demerits of that case and not based on a template of norms derived from mean values of select subject groups with ideal occlusion and proportion.

Keywords: Cephalometric norms, Steiners analysis, Tamil Nadu population

Introduction

Cecil.C.Steiner developed a form of cephalometric analysis with parameters which he viewed to be the most significant and would furnish the maximum clinical information with the least number of measurements^{1,2,3}. In his analysis, he took into consideration that it may not be possible to reach ideal proportions and relationships in all cases, but there are ways to maximize the esthetics. Steiner proposed appraisal of various parts of the skull separately, namely the **skeletal, dental and soft tissues**. The skeletal analysis entails relating the upper and lower jaws to the skull and to each other, whereas, the dental analysis relates to the upper and lower incisor teeth to

their respective jaws and to each other. Finally, the soft tissue analysis provides a means of assessing the balance and harmony of the lower facial profile^{4,5,6}.

The Norms established by Steiner from the Caucasian samples are still being widely used on the population groups all over the world. But various investigations suggest that the cephalometric norms vary among different age, sex and race.⁷ Cephalometric studies on different ethnic groups including those of Garcia's on Mexican Americans,⁸ Drummonds on Negros,⁹ Park's on Korean adults,¹⁰ Gleis on Israelis,¹¹ Miura on Japanese,¹² have indicated that Caucasian normal measurements cannot be considered normal for other racial groups. Other Indian studies include those of Kharbanda and Kotak on North Indians,¹³⁻¹⁵ Patel on Gujaratis,¹⁶ Kanappan on South Indians¹⁷ and John and Valiathan on Keralites¹⁸ have established their norms based on Steiner's analysis.

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So this study was conducted to establish skeletal and dental parameters for Tamil Nadu young adults using Steiner’s analysis.

Null hypotheses

Following is the *null hypotheses* of this study:

- (1) There is no difference in between Steiner’s value among Caucasians and South Indian population
- (2) There is no difference in between Steiner’s value among male and female South Indian population.

Materials and Methods

A total of 70 lateral cephalometric radiographs of Tamil Nadu young adults (35 females and 35 males; aged 18–28 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 subject’s head was positioned in the roentgenographic cephalostat maintaining a target-film distance of 5 feet 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 the time required for the exposure was 2.5 seconds.

The lateral cephalogram was 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 is taken into account to minimize the error.

The linear measurements were recorded with a measuring scale up to 0.05 mm correction. The angular measurements were recorded with a protractor.

Landmarks used in the Study

Skeletal measurements: Angle SNA, SNB, ANB, SND, Go-Gn to SN.

Dental measurements : Angle Maxillary 1 to NA, Mandibular 1 to NB, angle Maxillary 1 to Mandibular 1, angle Occlusal Plane to SN. Linear (mm) Maxillary 1 to NA line, Mandibular 1 to NB line, Pog to NB line.

Soft tissue measurements: S-line to upper lip prominence, S-line to lower lip prominence.

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.

Table-1: Comparisons between the mean Skeletal, Dental, Soft-tissue parameters—Male and Female Tamil Nadu samples

Parameters	Male			Female			significance	
	Average	SD	S.E	Average	SD	S.E	t-value	p-value
AGE	21.69	4.02	0.68	20.34	4.47	0.75	1.32	0.19#
SNA	84.97	3.71	0.63	83.45	2.92	0.49	1.89	0.06#
SNB	81.17	4.11	0.7	80.06	2.82	0.48	1.32	0.19#
SND	77.77	3.43	0.58	77.01	2.92	0.49	0.99	0.32#
Go Gn to SN	26.28	5.6	0.95	28.57	5.06	0.85	1.78	0.08#
ANB	3.82	2.9	0.49	3.42	1.77	0.3	0.7	0.49#
1 to NA(mm)	6.21	3.16	0.54	6.35	0.28	0.39	0.22	0.83#
1 to NA(Degree)	27.11	9.88	1.66	27.63	8.3	1.4	0.24	0.81#

Cont... Table-1: Comparisons between the mean Skeletal, Dental, Soft-tissue parameters—Male and Female Tamil Nadu samples

Li to NB(mm)	6.15	3.09	0.52	5.94	2.48	0.42	0.32	0.75#
Li to NB(Degree)	26.17	7.97	1.34	26.67	6.98	1.18	0.28	0.78#
Po to NB	1.47	2.3	0.39	1.61	1.31	0.22	0.31	0.75#
Interincisal angle	114.11	12.85	2.17	114.54	11.68	1.97	0.15	0.88#
Occl plane to SN	12.23	4.08	0.69	14.45	5.96	1	1.82	0.07#
Upper lip to S line	2.76	2.15	0.36	2.82	4.21	0.71	0.08	0.93#
Lower lip to S line	4.14	3.48	0.59	3.6	2.71	0.46	0.72	0.47#

Data are presented Average; SD=Standard Deviation; SE=Standard error of mean. * $p < 0.05$ Statistically significant #. $p > 0.05$ Not Statistically significant (NS).

Table 2: Comparative of present study and the Steiner’s norm

Parameters	Caucasian norms	Average	SD	S.E	t-value	p-value
SNA	82	84.21	3.40	0.41	5.44	<0.0001*
SNB	80	80.61	3.54	0.42	1.45	0.15#
SND	76	77.39	3.19	0.38	3.65	0.0005*
Go Gn to SN	32	27.43	5.43	0.65	7.04	<0.0001*
ANB	2	3.63	2.40	0.29	5.68	<0.0001*
I to NA(mm)	4	6.28	2.74	0.33	13.07	<0.0001*
I to NA(Degree)	22	27.37	9.06	1.08	8.65	<0.0001*
Li to NB(mm)	4	6.04	2.79	0.33	9.16	<0.0001*
Li to NB(Degree)	25	26.42	7.45	0.89	6.09	<0.0001*
Interincisal angle	131	114.33	12.20	1.46	11.43	<0.0001*
Occl plane to SN	14	13.34	5.20	0.62	1.06	0.29#
Upper lip to S line	0	2.79	3.33	0.40	7.01	<0.0001*
Lower lip to S line	0	3.87	3.11	0.37	10.4	<0.0001*
Po to NB		1.54	1.86	0.22		

Data are presented Average; SD=Standard Deviation; SE=Standard error of mean. * $p < 0.05$ Statistically significant. # $p > 0.05$ Not Statistically significant (NS).

Table 3: Comparison of cephalometric values of present study (Tamil Nadu Samples) with Caucasians, Israelis, Koreans, Mexican Americans, Japanese and Negroes using Steiner's norms

Parameters	Caucasian Steiner	Present study N=70	Israelis (Ruth et al) N=40	Korean (Park et al) N=80	Mexican American (Garcia) N=59	Japanese (Miura et al) N=40	Negroes (drummond) N=40
SNA	82	84.21	81.63	81.15	83.6	81.3	84.7
SNB	80	80.61	78.2	78.7	80.8	76.8	79.2
SND	76	77.39	75.198	77.3	77.3	73.4	75.8
Go Gn to SN	32	27.43	34.63	33.4	31.1	36.2	38.2
ANB	2	3.63	3.43	2.5	2.8	4.5	5.5
I to NA(mm)	4	6.28	5.2	7	5.5	5.9	7.4
I to NA(Degree)	22	27.37	23.8	23.4	20.5	24.1	24.1
Li to NB(mm)	4	6.04	6.46	7.2	5.7	7.8	11.4
Li to NB(Degree)	25	26.42	28.46	27.4	26.7	31.2	36.7
Interincisal angle	131	114.33	124.21	126.55	130	120.3	113.8
Occl plane to SN	14	13.34	17.68	16.9	15.8	20	
Upper lip to S line	0	2.79					
Lower lip to S line	0	3.87					
Po to NB		1.54	5.38	1.8	0.9	0.43	

Results

Comparisons between the mean angular and linear parameters—male and female Tamil Nadu subjects (Table 1)

Comparative statistical evaluation of Steiner's norm and the Tamil Nadu subjects (Table 2)

Comparison of cephalometric values of present Tamil Nadu subjects with Caucasians, Israelis, Koreans, Mexican Americans, Japanese and Negroes using

Steiner's norms (Table 3)

Discussion

The present study has tried to establish skeletal and dental Cephalometric norms for young Tamil Nadu adults according to Steiner's analysis. These norms were compared with standards established by Steiner as and other racial groups.

Skeletal

Angles SNA reveals that the maxillary apical base

in the Tamil Nadu sample is more prognathic. The males exhibited a more prominent maxilla ($p < 0.05$). Angle SNB did not show any statistically significant difference with the Caucasians or between males and females group.

ANB showed an increase in mean value when compared to Caucasians.

When compared to females the male samples showed a slight increase in SNA, SNB, ANB and SND angles.

The linear measurement Pog-NB was found to be more in females than males and was statistically significant ($p < 0.01$).

The mandibular plane to the cranial base plane of Tamil Nadu adults revealed that the angle was smaller than the Steiner's norm. From this study, it can be said that the Tamil Nadu samples exhibited a more horizontal growth pattern than the Caucasians. The study recorded that

The female sample showed an increase in the mean value when compared to the male.

The Tamil Nadu sample showed a lesser inclination of occlusal plane among the male samples when compared to the Caucasians, whereas no marked variation was seen among female subjects.

Dental

Measurements upper incisor to NA and lower incisor to NB (angular and linear) showed an increased value for the Tamil Nadu samples ($p < 0.001$). These findings along with a more acute interincisal angle of the Tamil Nadu samples reveal that the upper and lower incisors of subjects are more procumbent and protracted when compared with that of Caucasians. The male and females did not show any significant difference ($p < 0.01$).

Soft Tissue

The S-line to the upper lip and lower lip showed an increase in the mean value for both male and female Tamil Nadu samples when compared to the Caucasians subjects. Upper lip to S-line did not show any significant difference among male and female samples, whereas the

male samples lower lip to S-line showed an increase in the mean value when compared to the female.

Comparison of Tamil Nadu sample with other population groups

Comparison with Israeli population group

The Israeli group showed a decreased SNA, SNB, SND and increased ANB when compared to the Caucasian population, the Israeli subjects revealed a vertical growth pattern when compared to Caucasians. The upper and lower incisors linear and angular measurements increased and the interincisal angle decreased when compared to the caucasians¹¹.

The present study showed an increase in SNA, SNB, SND and ANB when compared to the Israeli population. The present study reveals a horizontal growth pattern whereas Israeli group had a vertical growth pattern. Upper incisor linear and angulations mean value increased and the lower incisor linear and angular measurements decreased in the present Tamil Nadu sample group when compared to Israeli population. Linear measurement Pog-NB showed a decrease mean value when compared to Israeli population

Comparison with Mexican American population group

The Mexican American group showed an increased SNA, SND, ANB and SNB when compared to the Caucasian population, the Israeli subjects revealed an average growth pattern when compared to Caucasians. The upper incisor linear measurement and lower incisors linear and angular measurements increased and the upper incisor angulation decreased. Interincisal angle was average when compared to the caucasians⁸.

The present study showed an increased SNA, ANB, no difference was seen in between the SNB, SND when compared to the Mexican American population. The present study reveals a horizontal growth pattern whereas Mexican American group had a average growth pattern. Upper and lower incisor linear measurement and upper incisor angulations mean value increased the lower incisor angular measurements and interincisal angle decreased in the present Tamil Nadu sample group when compared to the Mexican American population. Linear measurement Pog-NB showed an increased mean value

when compared to the Mexican American population.

Comparison with Negroes population group

The Negroes group showed an increased SNA, ANB, mandibular plane and decreased SNB, SND when compared to the Caucasian population, the upper and lower incisor linear and angular measurements increased and the interincisal angle was decreased when compared to the caucasians population group⁹.

The present study showed an increased SNB, SND ANB and no difference was seen in between the SNA angle when compared to the Negroes population. The present study reveals a horizontal growth pattern whereas Negroes group had a vertical growth pattern. Upper incisor angular measurement increased whereas the upper and lower incisor linear measurement and lower incisor angulations measurements value decreased in the present Tamil Nadu sample group when compared to Negroes population. The interincisal angle increased when compared to the negroes sample group.

Comparison with Korean population group

The Korean group showed a decreased SNA, SNB, SND and increased ANB and mandibular plan when compared to the Caucasian population, the Korean. The upper and lower incisors linear and angular measurements increased and the interincisal angle decreased when compared to the caucasians¹⁰.

The present study showed an increase in SNA, SNB, SND, ANB and decreased mandibular plane when compared to the Korean population. Upper incisor showed decreased linear measurement and increased angular measurements. The lower incisor showed decreased linear measurement and decreased was seen in angular measurements when compared to the Korean population. Linear measurement Pog-NB showed a decrease mean value when compared to the Korean population.

Comparison with Japanese population group

The Japanese group showed a decreased SNA, SNB, SND and increased ANB and mandibular plan when compared to the Caucasian population, the Japanese. The upper and lower incisors linear and angular measurements increased and the interincisal

angle decreased when compared to the caucasians¹².

The present study showed an increase in SNA, SNB, SND and decreased ANB, mandibular plane when compared to the Japanese population. The upper incisor showed increased linear measurement and angular measurements. The lower incisor showed decreased linear measurement and angular measurements when compared to the Japanese population. Linear measurement Pog-NB showed a increased mean value when compared to the Japanese population.

The Cephalometric norms of young Tamil Nadu adults compared with standards established by Steiner as and other racial groups showed variation in their mean value. Various other study also Comparing cephalometric values among other Indian population also showed variations.^{7, 14-18}

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

Conclusion

The result of the study supports the fact that the 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. A case of malocclusion needs to be treated based on the individual merits and demerits of that case and not based on a template of norms derived from mean values of select subject groups with ideal occlusion and proportion.

The following differences and similarities were demonstrated in Tamil Nadu samples as compared to the Caucasian samples.

1. Tamil Nadu male group had a more prognathic maxilla than the female group. The anteroposterior position of the apical base of the maxilla in relation to the anterior cranial base was more anteriorly placed or prognathic as compared to the Caucasian samples.
2. Tamil Nadu male group had a more prognathic

mandible than the female group. The anteroposterior position of the apical base of the mandible in relation to the anterior cranial base did not show a significant difference as compared to the Caucasian samples.

3. The Tamil Nadu male group reported with a more prominent chin than the female group. The position of the center of the symphysis was placed more forwards than the Caucasian samples.
4. The angular relationship of the mandibular plane in relation to the cranial base plane (SN GoGn angle) was smaller which was suggestive of a horizontal growth pattern in the Tamil Nadu population.
5. The Tamil Nadu population has a protrusive alveodental pattern when compared to the Caucasians.
6. The labial inclination of the incisors was more proclined when compared to the Caucasians.
7. The Tamil Nadu population has a protrusive upper and lower lip when compared to the Caucasian population.

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