



## Cephalometric Evaluation-based on Steiner's Analysis on Young Adults of Chhattisgarh, India

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### ABSTRACT

**Aim:** The study was conducted to establish skeletal and dental parameters for Chhattisgarhi young adults, evaluation of variability between male and female Chhattisgarhi normal occlusion subjects and comparison of Cephalometric norms of Chhattisgarh population with Caucasians as well as other non-Caucasian groups.

**Materials and methods:** A Cephalometric study of 80 Chhattisgarhi young adults (40 males and 40 females) with acceptable profile and occlusion was carried out by means of Steiner's analysis.

**Results:** In comparison to the Caucasian samples, the Chhattisgarhi samples were more protrusive skeletally and dentally and exhibited a more horizontal growth pattern than the Caucasians. The females reported with an increased incisor procumbency, prominent chin and prognathic maxilla than their male counterparts.

**Conclusion:** The results of the study support the fact that a case of malocclusion cannot be treated to a template of norms which have been derived from mean values of a certain select group of subjects with excellent occlusion and harmonious facial proportions.

**Clinical significance:** A case of malocclusion needs to be treated based on the individual merits and demerits of that case and not based on template of norms derived from mean values of select subject groups with ideal occlusion and proportion.

**Keywords:** Steiner's analysis, Cephalometric norms, Chhattisgarh.

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### INTRODUCTION

The establishment of cephalometric<sup>1</sup> norms for local population and their consequent clinical application

contributes to a more satisfactory diagnosis and treatment planning for patients hailing from a particular ethnic background.

It is evident from the studies of numerous investigators that the cephalometric norms vary among different age, sex and race.<sup>10</sup>

Norms established from the Caucasian samples are still being widely used on the population groups all over the world, resulting in unpleasant and unsatisfactory results.

Cephalometric studies on different ethnic groups including those of Garcia's on Mexican Americans,<sup>2</sup> Drummonds on Negroes,<sup>9</sup> Park's on Korean adults,<sup>13</sup> Gleis on Israelis,<sup>12</sup> Miura on Japanese<sup>11</sup> have indicated that Caucasian normal measurements cannot be considered normal for other racial groups.

As such, there is an acute necessity in devising and standardizing Indian norms based on ideal/normal faces which can be used as a standard template to compare and study deviations and values as pertinent to the Indian population.

The earliest cephalometric studies in India were conducted at Mumbai as part of MDS Dissertations on Gujarati population by Kotak (1961), Sheshadri (1964), Mathur (1964) on Maharashtrians; Shetye (1962) on Parsis and Maharashtrians by Sidhu (1969).<sup>15</sup>

Other Indian studies include those of Kharbanda and Kotak on North Indians,<sup>3-5</sup> Patel on Gujaratis,<sup>8</sup> Kanappan on South Indians<sup>15</sup> and John and Valiathan on Keralites<sup>14</sup> have established their norms on the basis of Steiner's analysis.

A number of Indian studies have been compiled as a booklet which has been published by the Indian Orthodontic Society.<sup>8</sup> However, no study has been conducted on the population of Chhattisgarh. It was therefore essential to undertake such a study for young population of Chhattisgarh and observe various hard tissue cephalometric values by means of Steiner's analysis.<sup>6,7</sup>

## AIMS AND OBJECTIVES

The following objectives are accomplished by this study:

1. Establishment of skeletal and dental parameters for Chhattisgarhi young adults using Steiner's analysis.
2. Evaluation of variability between male and female Chhattisgarhi normal occlusion subjects.
3. Comparison of cephalometric norms of Chhattisgarh population with that of Caucasians and other groups.

## MATERIALS AND METHODS

A total of 80 lateral cephalometric radiographs of Chhattisgarhi young adults (40 females and 40 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 by a single orthodontist at Government Dental College, Raipur.

### Landmarks used in the Study

**Angular Measurements:** Angle SNA, SNB, ANB, SND, Maxillary 1 to NA, Mandibular 1 to NB, Maxillary 1 to Mandibular 1, Occlusal Plane to SN, Go-Gn to SN.

**Linear Measurements (mm):** Maxillary 1 to NA line, Mandibular 1 to NB line, Pog to NB line, SL line and SE line.

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 Frankfort Horizontal plane 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 (Figs 1 and 2).

The kilo voltage used for X-ray exposure was 61 to 85 kVp. 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 3HB hard lead pencil over a well-illuminated viewing screen (Fig. 3).

Each cephalogram was traced twice and the average measurement 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 up to 0.05 mm correction. 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.



**Fig. 1:** The subject was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion during the exposure of the films



**Fig. 2:** The subject's head was positioned so that the Frankfort horizontal plane would be parallel to the floor during the exposure of the films



**Fig. 3:** A4 size acetate matt tracing sheet with a 3HB hard lead pencil over a well-illuminated viewing screen

The mean values of this study have been compared with the Steiner's norms for Caucasian subjects. On the basis of this data, a complete chart of the Steiner's analysis was established for young Chhattisgarhi adult population.

**RESULTS**

The results of the present study are presented in Tables 1 to 4.

**DISCUSSION**

Caucasian norms are still used in the orthodontic treatment of Indian patients, despite the different ethnic backgrounds of Indians, whereas researchers worldwide have paid attention to the ethnic factor and tried to establish cephalometric values for various groups. The results of their studies demonstrate that those groups do, indeed, differ in several parameters.

The present study has tried to establish skeletal and dental Cephalometric norms for young Chhattisgarhi adults

according to Steiner's analysis. These norms were compared with standards established by Steiner as and other population groups.

The results show that most of the mean values for the Chhattisgarhi sample differ from Steiner's original value.

The findings of the present study are discussed under two headings, the first for skeletal pattern and the other for dental pattern.

**Skeletal**

Angles SNA and SNB reveal that the maxillary and the mandibular apical base in the Chhattisgarhi sample are more prognathic. The females exhibited a more prominent maxilla than the males ( $p < 0.05$ ). Angle ANB did not show any statistically significant difference with the Caucasians or between males and females group.

The mean value of angle SND was more in Chhattisgarhi subjects indicating that the position of the center of the

**Table 1:** Comparisons between the mean angular and linear parameters—male and female Chhattisgarhi subjects

S. No.	Parameters	Male (n = 40)			Female (n = 40)			Significance	
		Mean	SD	SE	Mean	SD	SE	t-value (df = 78)	p-value
1.	< SNA°	83.52	2.06	0.33	84.62	2.29	0.25	2.25	p < 0.05
2.	< SNB°	81.85	2.08	0.32	82.55	2.59	0.28	1.33	NS
3.	< ANB°	1.72	0.70	0.11	2.07	1.00	0.11	1.81	NS
4.	< SND°	79.07	1.91	0.30	79.3	2.14	0.23	0.50	NS
5.	< SN-GoGn°	27.42	3.26	0.51	27.37	2.98	0.33	0.07	NS
6.	< SN-Occ°	13.22	1.78	0.28	13.57	2.62	0.29	0.69	NS
7.	< 1 To NA°	26.15	2.45	0.38	26.17	2.69	0.30	0.03	NS
8.	< 1 To NB°	29.92	2.33	0.36	29.42	2.40	0.26	0.00	NS
9.	< 1 To 1°	125.67	4.74	0.74	122.67	4.50	0.50	2.90	p < 0.01
10.	1 To NA Linear (mm)	6.95	1.54	0.24	6.82	1.28	0.14	0.41	NS
11.	1 To NB Linear (mm)	6.77	1.47	0.23	6.45	1.18	0.13	1.07	NS
12.	SE (mm)	22.35	2.11	0.33	21.45	1.61	0.18	2.14	p < 0.001
13.	SL (mm)	55.4	2.92	0.46	54.72	2.71	0.30	1.07	NS
14.	Pog – NB (mm)	0.27	2.47	0.39	1.62	0.73	0.08	3.31	p < 0.01

NS: Not significant ( $p > 0.05$ );  $p < 0.05$ : significant at 5% level;  $p < 0.01$ : Significant at 1% level;  $p < 0.001$ : Significant at 0.1% level

**Table 2:** Comparative statistical evaluation of Steiner's norm and the present study

S. No.	Parameters	Caucasian norms	Chhattisgarhi sample (n = 80)			Statistical evaluation	
			Mean	SD	SE	t-value (df = 78)	p-value
1.	< SNA°	82	84.07	2.25	0.25	8.28	p < 0.001
2.	< SNB°	80	82.2	2.37	0.26	8.46	p < 0.001
3.	< ANB°	2	1.90	0.88	0.09	-1.02	NS
4.	< SND°	76	79.18	2.03	0.22	14.45	p < 0.001
5.	< SN-GoGn°	32	27.40	3.12	0.34	-13.52	NS
6.	< SN-Occ°	14	13.40	2.25	0.25	-2.4	NS
7.	< 1 To NA°	22	26.16	2.57	0.28	14.85	p < 0.001
8.	< 1 To NB°	25	29.67	2.37	0.26	17.96	p < 0.001
9.	< 1 To 1°	131	124.21	4.66	0.52	-9.21	NS
10.	1 To NA linear (mm)	4	6.88	1.42	0.15	19.2	p < 0.001
11.	1 To NB linear (mm)	4	6.61	1.34	0.14	18.64	p < 0.001
12.	SE (mm)	22	21.9	1.93	0.21	-0.47	NS
13.	SL (mm)	51	55.06	2.82	0.31	13.09	p < 0.001
14.	Pog – NB (mm)		1.03	1.94	0.21		

NS: Not significant ( $p > 0.05$ );  $p < 0.05$ : Significant at 5% level;  $p < 0.01$ : Significant at 1% level;  $p < 0.001$ : Significant at 0.1% level.

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

S. No.	Cephalometric analysis	Caucasian Steiner	Present study (CG) (n = 80)	Israelis (Ruth et al) (n = 40)	Korean (Park et al) (n = 80)	Mexican Americans (Garcia) (n = 59)	Japanese (Miura et al) (n = 90)	Negroes (Drummond) (n = 40)
1.	< SNA°	82	84.07	81.63	81.15	83.6	81.3	84.7
2.	< SNB°	80	82.2	78.2	78.7	80.8	76.8	79.2
3.	< ANB°	2	1.90	3.43	2.5	2.8	4.5	5.5
4.	< SND°	76	79.18	75.31	75.8	77.3	73.4	75.8
5.	< SN-GoGn°	32	27.40	34.63	33.4	31.1	36.2	38.2
6.	< SN-Occ°	14	13.40	17.68	16.9	15.8	20	
7.	< 1 To NA°	22	26.16	23.8	23.4	20.5	24.1	24.1
8.	< 1 To NB°	25	29.67	28.46	27.4	26.7	31.2	36.7
9.	< 1 To 1°	131	124.21	124.34	126.55	130	120.3	113.8
10.	1 To NA linear (mm)	4	6.88	5.2	7	5.5	5.9	7.4
11.	1 To NB linear (mm)	4	6.61	6.46	7.2	5.7	7.8	11.4
12.	SE (mm)	22	21.9			21.3	21	
13.	SL (mm)	51	55.06			53.9	41.1	
14.	Pog – NB (mm)		1.03	5.38	1.8	0.9	0.43	

**Table 4:** Comparison of cephalometric values of present study (Chhattisgarh population), Caucasian and other Indian races using Steiner's reference norms

S. No.	Cephalometric analysis	Caucasian Steiner	Present Study (CG) (n = 80)	North Indian (Kharbanda) (n = 45)	Gujarathi (Patel HM al) (n = 30)	Assam (Bora & Baruah) (n = 70)	South Indian (Kanappan) (n = 100)	Kerala (John KK) (n = 50)
1.	< SNA°	82	84.07	82.6	81.26	84.5	82.6	84.14
2.	< SNB°	80	82.2	79.21	78.25	81.41	79.9	81.85
3.	< ANB°	2	1.90	3.27	3.01	3.01	2.7	2.27
4.	< SND°	76	79.18		75.6	78.67	77.3	79.36
5.	< SN-GoGn°	32	27.40	27.03	29.06	26.6	31.0	27.91
6.	< SN-Occ°	14	13.40		15.7	13.63		11.79
7.	< 1 To NA°	22	26.16	23.56	25.34	25.04	23.5	27.44
8.	< 1 To NB°	25	29.67	27.76	30.67	29.26	26	30.75
9.	< 1 To 1°	131	124.21	124.20	120.63	122.71	128	119.69
10.	1 To NA linear (mm)	4	6.88	5.94	6.48	4.11	4.2	7.46
11.	1 To NB linear (mm)	4	6.61	6.42	7.13	4.63	5.2	7.50
12.	SE (mm)	22	21.9	20.48	20.6	20.97	22.2	21.46
13.	SL (mm)	51	55.06	53.66	51.7	53.17	50.9	59.66
14.	Pog – NB (mm)		1.03			2.32		1.06

symphysis was placed more forwards than the Caucasian sample ( $p < 0.001$ ). On comparison between male and female Chhattisgarhi subject, it was seen that there was no significant difference between them.

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 Chhattisgarhi adults revealed that the angle was smaller than the Steiner's norm. From this study, it can be said that the Chhattisgarhi group pattern exhibited a more horizontal growth pattern than the Caucasians. The study recorded that there was no significant difference in the mean values between the boys and girls.

Chhattisgarhi population showed a lesser inclination of occlusal plane (13.40), than the Caucasians. There was no marked variation between male and female subjects.

## Dental

Measurements 1 to NA and 1 to NB (angular and linear) recorded a greater value for the Chhattisgarhi subjects ( $p < 0.001$ ). These findings along with a more acute interincisal angle of the Chhattisgarhi young adults reveal that the upper and lower incisors of Chhattisgarhi subjects are more procumbent and protracted when compared with that of Caucasians. The females exhibited a lesser interincisal angle value than the male Chhattisgarhi subjects ( $p < 0.01$ ).

The measurement SE (to locate the mesiodistal mandibular condyle position) did not show any significant difference with the Caucasian group, however, there was statistically significant difference between the male and female subjects ( $p < 0.001$ ).

The measurement SL (to measure the anteroposterior length of the mandible) was recorded higher in the

Chhattisgarhi group ( $p < 0.001$ ). There was no statistical difference between the male and female groups.

In Chhattisgarhi samples, the mean value of the bony chin position in relation to the NB plane (Pog to NB) was 0.95 mm; with a SD of +1.94 mm. Steiner has not established any norm for this parameter. There were significant differences between the male and female Chhattisgarhi subjects ( $p < 0.01$ ).

## SUMMARY AND CONCLUSION

The findings of the present study have revealed that certain fundamental variation exists in the craniofacial structures of the so called well balanced faces of Chhattisgarhi population when compared with Steiner's norms.

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

1. The anteroposterior position of the apical base of the maxilla and mandible in relation to the anterior cranial base was more anteriorly placed or prognathic as compared to the Caucasian samples. Chhattisgarhi female group had a more prognathic maxilla than the male group.
2. The position of the center of the symphysis was placed more forwards than the Caucasian samples. The Chhattisgarhi female group reported with a more prominent chin than the male group.
3. The angular relationship of the mandibular plane in relation to the cranial base plane (SN-GoGn angle) was smaller which was suggestive of a strong horizontal growth pattern in the Chhattisgarhis.
4. The Chhattisgarhi population has a protrusive alveodental pattern when compared to the Caucasians. The labial inclination of the incisors was found to be more in the female Chhattisgarhi subjects.
5. There was wide divergence of the SL distance in the Chhattisgarhi population when compared to the Caucasians.

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