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A cephalometric comparison of horizontal and vertical skeletal parameters in North and South Indian population groups

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ABSTRACT

A cephalometric study was carried out to compare skeletal parameters between North Indian (Group A) and South Indian (Group B) population. Sixty subjects in the age group of 16–21 years with acceptable profile, class I molar and canine relationship were selected. Cephalometric records were obtained for both the groups (A&B) and digitized. SNA, SNB, Wits appraisal (AO-BO), Mandibular Base (Go-Pog), Maxillary Base (PNS-Point A), Effective Mandibular Length (Co-Gn) and Mid-Facial Length (Co-Point A) readings were assessed to determine any difference in horizontal parameters. Similarly, Y-axis, Mandibular Plane Angle (MPA), Mandible to Cranial Base (FMA), Gonial Angle (GA), Upper and Lower Gonial Angle of Jarabak (UGA & LGA), Total Facial Height (TFH), Upper anterior Facial height (UAFH), lower anterior facial height (LAFH), Posterior Height/Total Anterior Height Ratio (PH/TAH) were digitized to find any difference in vertical parameters. Statistical analysis using paired *t*-test was done with level of significance less than 5%. Results showed that, South Indian girls had more MPA and FMA compared to the North Indians suggesting a tendency towards vertical growth pattern. This cephalometric appraisal study shall enable an orthodontist in formulating an optimal treatment plan for the two population groups.

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1. Introduction

Cephalometry is a vital clinical tool in orthodontics for evaluation of craniofacial complex, determination of growth and morphology, planning treatment and forecasting future maxillo-mandibular relationships. The craniofacial features are either of genetic origin, nutritionally acquired or are specific to some ethnic, racial, sub-racial as well as different community groups.[1] The cephalometric norms established for Caucasians using various analysis[2,3] showed that these values differ from one race to another. Bhat et al[4] found that different racial or ethnic groups tend to have different craniofacial features, establishing their own norms for the individuals. Such ethnic diversity has already been proved between white and black Brazilian subjects where black Brazilian subjects have bimaxillary skeletal, dento-alveolar and soft tissue protrusion when compared to white Brazilian subjects.[5] It is imperative for a clinician to understand various craniofacial morphological patterns of the heterogeneous ethnic and racial mixtures in the Indian population.

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The purpose of the present study was to compare horizontal & vertical parameters in North and South Indian population groups.

2. Aims and objectives

1. To evaluate the differences in the horizontal skeletal parameters in North Indians and South Indians.
2. To evaluate the differences in the vertical skeletal parameters between the North Indians and South Indians.
3. To compare the norms of the present study with other ethnic population groups.

3. Material and methods

The present study was conducted on a sample of 500 female subjects in the age group of 16–21 years. These subjects were selected irrespective of region, cast, sex etc. The sample comprised of two Indian population groups – Group A (North Indian) inhabitants of Punjab, Haryana, Chandigarh, Delhi and U.P. and Group B (South Indian) inhabitants of Tamil Nadu, Andhra Pradesh and Kerala excluding the tribal population. To ascertain the place of origin of the subjects, the family lineage of each subject was traced up to 3 generations. 60 female subjects were selected on the basis of the following inclusion criteria:

1. Acceptable profile and occlusion.
2. All the teeth up to second molars fully erupted in class I molar and canine relationships.
3. Acceptable over jet and overbite.
4. No spacing/crowding or rotations of teeth.
5. No previous history of orthodontic treatment.

Also, informed consent was taken from subjects for participation in the study. Further, lateral cephalograms were advised for skeletal pattern evaluation. Customized cephalometric analysis was done to compare sagittal and vertical parameters (Table 1) for both the groups. Overall eight angular and nine linear digitized parameters were assessed (Fig. 1).

Table 1 – Horizontal and vertical parameters.

Horizontal parameters	Vertical parameters
1. SNA	1. Y-axis
2. SNB	2. Mandibular Plane Angle (MPA)
3. Witts Appraisal (AO-BO)	3. Mandible to Cranial Base (FMA)
4. Mandibular Base (Go-Pog)	4. Gonial Angle (GA)
5. Maxillary Base (PNS-Point A)	5. Upper Gonial Angle of Jarabak (UGA)
6. Effective Mandibular Length (Co-Gn)	6. Lower Gonial Angle of Jarabak (LGA)
7. Mid-Facial Length (Co-Point A)	7. Total Facial Height (TFH)
	8. Upper anterior Facial height (UAFH)
	9. Lower anterior facial height (LAFH)
	10. Posterior Height/Total Anterior Height Ratio (PH/TAH)

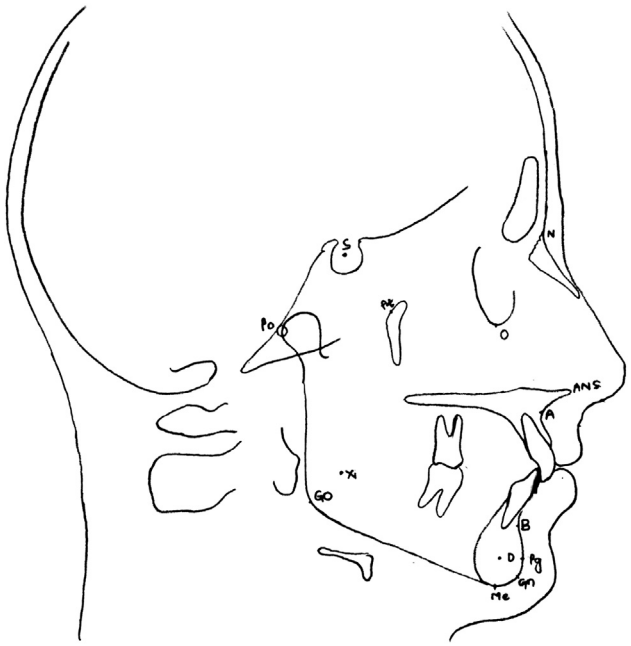


Fig. 1 – Cephalometric tracing.

4. Results and statistics (Table 2 and 3)

The data was tabulated and analysed using SPSS software (version 11.5) for further analysis. Comparison between the two groups was carried out using the paired student's t-test. The level of significance was 5% ($p < 0.05$). Six angular and four linear vertical parameters were assessed. These included MPA and FMA, which showed a significant difference with p value of 0.010 and 0.045 respectively. Y-axis, Gonial Angle, Upper Gonial Angle, Lower Gonial Angle were similar in both the population groups with p-value of 0.240, 0.086, 0.747, 0.133 respectively. Also, the other vertical linear measurements between the two groups were statistically insignificant. This included TFH, UAF, LAFH and PH/TAH Ratio with p-value of 0.945, 0.569, 0.927 and 0.076 respectively. Amongst the horizontal linear parameters, AO-BO showed a significant

Table 2 – Results of vertical parameters.

Parameter	Group A		Group B		P-value
	Mean	SD	Mean	SD	
Y-axis	64.07	3.16	65.07	3.21	0.240
MPA	23.48	5.06	27.17	5.40	0.010*
FMA	26.11	4.84	28.97	5.75	0.045*
GA	119.07	4.72	122.33	8.81	0.086
UGA	49.80	2.79	50.19	5.79	0.747
LGA	69.21	3.84	70.95	4.81	0.133
TFH	112.17	5.16	112.27	5.51	0.945
UAF	52.62	3.03	52.17	2.88	0.569
LAFH	59.14	3.50	59.03	5.38	0.927
PH/TAH	69.36	4.25	67.31	4.37	0.076

*Significant.

Table 3 – Results of horizontal parameters.

Parameter	Group A		Group B		P-value
	Mean	SD	Mean	SD	
SNA	81.23	3.11	81.05	3.58	0.846
SNB	78.45	3.32	78.92	3.17	0.589
AO-BO	−0.82	2.93	1.26	2.44	0.005*
Md-BASE	76.12	3.86	76.64	4.85	0.653
MAX-BASE	49.07	2.70	51.08	5.93	1.03
EMnL	110.66	4.09	112.05	5.12	0.256
Mid-FL	88.41	3.19	88.99	3.70	0.525

*Significant.

difference between the two groups with p-value of 0.005. SNA, SNB, mid-facial length, mandibular base and mandibular position were similar in both the groups with p-value of 0.846, 0.589, 0.449, 0.653 and 0.449 respectively. Maxillary base and effective mandibular length, though not statistically significant, was more in Group B compared to Group A with p-value of 0.103, 0.653 respectively. Amongst the horizontal angular measurements SNA and SNB were similar in both the groups with p-value of 0.846, 0.589 respectively.

5. Discussion

In this study, we compared and evaluated the cephalometric norms of North Indian and South Indian subjects with normal occlusion and well-balanced lateral profiles.

5.1. *Vertical angular parameters*

The results of present study showed significant difference between MPA and FMA for both the groups. Mean average for MPA and FMA in Group B was found to be more than Group A, indicating Group B girls had higher mandibular plane angle than Group A. This suggests a tendency towards vertical growth pattern. Similarly average for Y-axis, GA, UGA and LGA though insignificant but found to be higher in Group B, suggesting a tendency for vertical growth pattern in South Indian population. This observation is in consensus with the earlier study of South Kanara[6] children where the subjects showed an increased vertical growth. Similar results were found by Ashima[7] on Keralite adult population. Also, Syam et al[8] found that Hyderabadi population showed an increase in FMA when compared to that of Caucasians. Ioi et al[9] compared cephalometric norms between Japanese and Caucasian adults and observed that Japanese females have a significantly steeper mandibular plane angle and significantly larger lower facial height. Similarly, Bishara et al[10] compared dentofacial relationships of two adolescent populations from Iowa and Northern Mexico and reported a significant difference between two groups, i.e. North Mexican girls have relatively protrusive mandible.

Korath and Tandon[11] studied FMA for South Kanara children, and results indicated growth potential towards horizontal and downward growth. In the present study, the mean FMA value showed a significant difference between North Indian and South Indian population groups. Group A showed significantly lower FMA (26.1) compared to Group B (28.9) indicating a less vertical growth pattern than Group A.

5.2. *Vertical linear parameters*

Results of present study showed similarity between the two groups. All the linear measurements that included TFH, UAF, LAFH and PH/TAH were similar in both the groups with mean average suggesting almost equal lengths. Hwang et al[12] compared 60 Koreans and 42 European-American adults and observed that Koreans have a lower angle of inclination and higher degree of lip protrusion when compared to European-Americans. Lahlou et al[13] compared dento-alveolar protrusion values in Moroccans population with other Arabic, Caucasian and Mediterranean populations and concluded that these cephalometric norms of Caucasians cannot be applied to Moroccans as they have a bi maxillary protrusion.

5.3. *Horizontal linear parameters*

The Wits appraisal value, which is affected by the cant of occlusal plane, was slightly more in North Indians when compared to South Indians. Along with genetic factors, various environmental factors like mastication stress can influence the occlusal plane as well as facial types and growth patterns[1] but the clinical significance of these differences may not be great.

The effective mandibular length was slightly greater in North Indians than the South Indian girls. Thomas and Valiathans[14] showed maximum values for effective mandibular length on adult South Indian and North Indian population groups, with South Indians showing longer mandible than North Indians. Bhat et al[4] found effective mandibular length to be greater in Bunt boys than the Bunt girls when compared to Brahmin children. The larger mandibular length in Bunts has been attributed to the fact that the resultant of trajectories of forces generated during mastication with hard and fibrous diet can influence both condylar and mandibular growth, whereas in Brahmins, soft diet tends to have a decreased condylar growth due to low masticatory functions.[1] Also, South Indians showed a longer mid-facial length compared to that of North Indians. Increased mid-facial length in South Indians compared to that of North Indians has been reported by Thomas and Valiathan.[14] Further, no significant difference was found in the lower anterior face height between South Indian and North Indian population groups.

6. Conclusion

1. South Indian girls (Group B) have a mandibular plane significantly steeper than those of North Indian (Group A).
2. Wits Appraisal (AO-BO) was slightly more in the North Indians when compared to the South Indians, thus showing a slight anterior placement of maxilla in the North Indians.
3. The effective mandibular length was found to be slightly more in North Indians than the South Indian girls, though statistically insignificant.
4. These findings shall enable an orthodontist in precise assessment of horizontal and vertical dento-skeletal

relationships and formulating an optimal orthodontic treatment plan for both the population groups.

Conflicts of interest

All authors have none to declare.

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