

Cephalometric Study of the Dentofacial Complex of North Indians*

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INTRODUCTION

The use of cephalometric roentgenology in the study of growth and development and in clinical practice of orthodontics is well established. Clinically it is of value in growth prediction, diagnosis, treatment planning and prognosis. It also shows in advance the limitation of treatment and serves as a scientific method for the assessment of treatment results.

Since the advent of roentgenographic cephalometry several analyses^{1,2,3,4,5} have been put forward by various research workers. All of these analyses presented average measurements of skeletal and/or dental patterns with their ranges in a sample. It was recommended that a case after treatment should attain maximum number of normal mean measurements.

The research of the last two decades of Cotton, Takano and Wong,⁶ Haralabakis,⁷ Altemus,⁸ and Kotak⁹ has indicated that normal measurements of one group cannot be considered normal for other racial groups. Thus different racial groups will have to be treated according to their own individual characteristics.

These conclusions stimulated the start of the present investigation to study the skeletodental complex and to establish norms for Indian individuals. Since

India is a subcontinent with a large number of racial subgroups and several religious and interracial mixtures, it was proposed, therefore, to study only the individuals derived from a North Indian Hindu population.

For the study of dentofacial patterns in the Lucknow group, it was decided to use the Downs analysis so that the results obtained could be compared with those of other racial groups already investigated.

REVIEW OF LITERATURE

After the introduction of Downs' analysis several orthodontists investigated whether his mean skeletofacial measurements of American Whites were applicable to other ethnic groups. Cotton, Takano and Wong⁶ applied Downs' analysis respectively to American Negroes, American Japanese, and American Chinese individuals. All came to the identical conclusion that the Downs mean values were not applicable to their respective groups.

Haralabakis⁷ used the Downs analysis on Greeks and concluded that the Greek dentofacial patterns, as a group, differed from those studied via the same analysis by other investigators. Jensen and Palling¹⁰ reviewed the literature on the gonial angle and reported differences in the mean gonial angle of different races.

Savage¹¹ studied dental patterns of Bantu children of West Lake Province of Tanganyika and resolved that bi-maxillary protrusion was a general feature in all individuals.

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Kotak⁹ applied Downs' analysis on Indian Gujrati girls with an age range of fourteen to seventeen years. He concluded that the mean facial angle of 84.98 degrees in Gujrati girls indicated a posterior position of the mandible in relation to the cranium when compared with an average 87.9 degrees of Downs' group. His readings of dental patterns also showed that the mandible was more distally placed and the anterior teeth were in protrusive relation. Altemus⁸ reported in his study on Negroes that the skeletal pattern of Negroes was almost identical, and the dental pattern was significantly protrusive when compared with standards of the Caucasian race given by Downs.

MATERIAL

This study is based on lateral head roentgenograms of fifty individuals, equally divided as to sex. The age range of our subjects was 17 to 25 years with average age of 20 years and 2 months. Average age of males was 20 years, 10 months and of females 19 years and 6 months. The individuals were selected on the basis of their excellent occlusions and well-balanced facial patterns.

All the subjects chosen had a full complement of permanent teeth in proper intercuspation with no rotations and no crowding of maxillary and mandibular incisors. The selected individuals were healthy and showed a good balance and harmony of dentofacial structures. The individuals were selected independently by three orthodontists and only those subjects were taken who were accepted by all three.

All the individuals were Hindus from the State of Uttar Pradesh, India, and had been living in Lucknow for several years. None of the subjects had received any orthodontic treatment. They belonged to middle and upper middle socio-economic groups.

METHOD

Standardized lateral cephalometric roentgenograms of individuals were taken with a Universal cephalometer (counter-balancing type) at the Dental College and Hospital in Lucknow.

All the landmarks, planes and angles used in the present study were according to the descriptions and definitions given by Downs.

To determine the error involved during the tracing of cephalograms, picking the landmarks, and taking the measurements, twenty-five cephalometric x-rays were retraced one month after the originals were done. The standard error calculated was found to be statistically insignificant.

RESULTS

No significant statistical difference was observed between the findings of male and female samples although the mean measurements of the female sample presented a slightly protrusive middle face.

The data are presented in Tables I and II.

DISCUSSION

The findings of the present study are discussed under two headings, the first for skeletal pattern and the other for dental pattern. In each group the results of the present study are also compared with findings of other investigators (Cotton, Takano and Wong, Altemus and Kotak) on their ethnic groups.

Skeletal Pattern

The mean values of facial angle, A-B plane to facial plane angle, and mandibular plane angle of the present study were slightly less than those presented by Downs and the mean angle of convexity was +1.45 in comparison to zero of Downs. The overall skeletal pattern of the present group appeared to be

TABLE I
SKELETAL PATTERN

MEASUREMENT	MEAN	S.e.m	S.D.	RANGE
Facial Angle	86.50	0.57	4.01	77.0 to 96.0
Angle of Convexity	1.45	0.82	5.80	-11.0 to 14.5
A-B Plane to Facial Plane	-3.25	0.60	4.25	-11.0 to 13.0
Mandibular Plane Angle	20.50	0.63	4.47	6.5 to 29.0
Y-Axis Angle	59.80	0.43	3.05	51.5 to 69.5

TABLE II
DENTAL PATTERN

MEASUREMENT	MEAN	S.e.m	S.D.	RANGE
Cant of Occlusal Plane	8.10	0.74	5.12	-2.0 to 22.5
$\underline{1}$ to \bar{I} Axis	128.80	1.15	8.11	112.5 to 151.5
\bar{I} to Occlusal Plane	23.10	0.82	5.80	9.0 to 36.5
\bar{I} to Mandibular Plane	10.00	0.65	4.98	-1.0 to 21.0
$\underline{1}$ to A-P Plane (mm)	5.75	0.31	2.20	1.0 to 9.0

mildly protrusive in comparison with the Downs standards. (Table III and Figure 1).

The ranges of all the dimensions of the skeletal pattern of the present study were much more than those obtained by Downs, denoting excessive retrusive and protrusive patterns of skeletal measurements although all selected individuals had a pleasant appearance.

A comparison of the skeletal pattern of the present study was made with three other ethnic groups, namely, Negroes, Chinese and Japanese. The

values of the present combined group were compared with the standard values of the Negro group of Altemus instead of Cotton's because the sample of Cotton's had a wide age span and was smaller in comparison with Altemus' group. Thus it was felt that the Altemus group would be more representative for Negroes.

Table III and Figure 1 show that facial angle is nearly similar in all ethnic groups except the Chinese (Wong) which exhibited a smaller angle in comparison with other racial groups. This

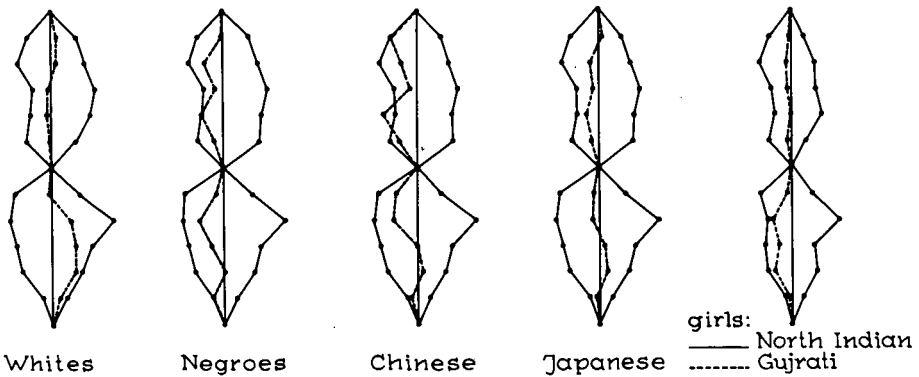


Fig. 1 Comparison of mean dentofacial patterns of American Whites, Negroes, Chinese, Japanese and Gujrati (West India) girls with the North Indian Hindu mean and ranges.

TABLE III
COMPARISON OF MEANS AND RANGES OF SKELETAL PATTERN IN FIVE ETHNIC GROUPS

Groups	Facial Angle	Angle of Convexity	A-B Plane Angle	Mandibular Plane Angle	Y-Axis
PRESENT	86.5	+ 1.45	- 3.25	20.5	59.8
North Indian	77.0 to 96.0	-11.0 to	14.5 to 13.0	6.5 to 29.0	51.52 to 69.5
DOWNNS	87.8	0.00	- 4.6	21.9	59.4
Caucasian	82.0 to 95.0	- 8.52 to	10.0 to 0.0	17.0 to 28.0	53.0 to 66.0
ALTEMUS	85.7	+ 9.7	- 6.3	28.8	63.4
Negroes	77.0 to 94.5	- 5.0 to	23.5 to 5.5	12.0 to 42.5	51.5 to 72.0
WONG	77.5	+ 7.5	- 5.7	32.4	67.1
Chinese	73.0 to 89.0	+ 1.5 to	+14.0 to -10.0	22.0 to 44.0	59.0 to 75.0
TAKANO	88.25	+ 3.65	- 4.35	24.3	62.1
Japanese	83.0 to 94.0	- 1.0 to	12.0 to - 7.0	14.0 to 33.0	56.0 to 68.0

showed the posterior position of the chin point of the Chinese in relation to the cranium.

The maximal and minimal values of Caucasians, Chinese and Japanese groups showed wide differences when compared with North Indian Hindus of the present study. The possible explanation for similar range values of Negroes and North Indian Hindus may be the large sample size of both groups which was eighty for the Negroes and fifty in the present study in comparison with twenty individuals each of Caucasian, Chinese and Japanese groups.

The angle of convexity was larger in Negroes, Chinese and Japanese groups with Hindus approaching the straight profile of Caucasians. This indicated that the maxillary part of the face was protrusive in Negroes, Chinese and Japanese in comparison with North Indian Hindus and Caucasians.

The mean A-B plane to facial plane angle was smallest in the present sample with a value of 3.25 degrees while the mean angle of -6.3 degrees (according to Cotton -7.7 degrees) for Negroes was the largest. This indicated that mandibular basal bone was more posterior in Negroes than Caucasians.

The mean mandibular plane angle was smallest in the present group and largest in the Chinese group indicating that, comparatively, North Indian Hindus had minimum, and Chinese had maximum, steepness of the mandibular base. The mean mandibular plane angle of the Caucasians was only 1.4 degrees more than the present sample, whereas the Japanese and the Negroes had a significantly larger angle.

The mean Y-axis angle was almost identical between North Indian Hindus and Caucasians. The Chinese had the largest mean angle which was 67.1 degrees in comparison with 59.8 degrees of the present group. This indicated that the Chinese had a more retrusive man-

TABLE IV
COMPARISON OF MEANS AND RANGES OF DENTAL PATTERN IN FIVE ETHNIC GROUPS

Groups	Mean	Cant of Occlusal Plane	Upper Incisor to Lower Incisor Axis	Lower Incisor to Occlusal Plane	Lower Incisor to Mandibular Plane	Upper Incisor to A-Po Plane (mm)
PRESENT	8.1	8.1	128.8	23.1	10.0	5.75
North Indian	Range	—2.0 to 22.5	112.5 to 151.5	9.0 to 36.5	—1.0 to 21.0	1.0 to 9.0
DOWNS		9.2	135.4	14.5	1.5	3.1
Caucasian		1.5 to 14.0	130.0 to 150.5	3.5 to 20.0	—8.5 to 7.0	—1.0 to 5.0
ALTEMUS		10.7	119.2	27.3	9.8	10.4
Negroes		—3.0 to 20.5	99.5 to 141.5	12.0 to 39.5	—5.5 to 24.5	3.0 to 19.0
WONG		16.9	120.8	22.2	7.8	7.6
Chinese		8.0 to 25.0	105.0 to 137.0	13.0 to 29.0	0.0 to 18.0	3.0 to 12.0
TAKANO		9.65	126.4	21.5	7.6	6.6
Japanese		2.0 to 19.0	114.0 to 152.0	8.0 to 31.0	—6.0 to 13.0	2.0 to 10.0

dible relative to cranium in comparison with the Hindus and the Caucasians.

The overall comparison of the skeletal patterns of various ethnic groups showed that skeletal morphology of the North Indian Hindus was very similar to the American whites. The Chinese group presented a distinct skeletal pattern having middle-face protrusion and lower face retrusion in relation to cranium when compared with the North Indian Hindus. The Negroes had middle face protrusion and slight retrusion of the lower face. The mean values of Japanese were nearer to the mean values of North Indians and Caucasians.

Dental Pattern

The mean values of dental pattern of the present study showed wide differences with the mean values offered by Downs. Except for the cant of the occlusal plane, the dental pattern of North Indian Hindus was significantly protrusive in comparison with Caucasians (Table IV, Figure 1).

The lower incisor to mandibular plane angle of the present group was an average of 10 degrees greater than the mean value established by various other investigators on the Caucasian with excellent occlusion (Margolis,¹ Tweed,² Downs³). Surprisingly, with the high degree of protrusive mean values of the dental pattern, all individuals in the present study exhibited pleasant appearance and good facial harmony. This indicated that, while treating North Indian Hindu subjects, a slight protrusion of teeth in comparison with Caucasian standards will be optimum for their features.

The overall comparison of the dental pattern of our group with those of Whites, Negroes, Japanese and Chinese groups is presented in Table IV and Figure 1.

The mean interincisal angle was largest in the Caucasians and smallest in

the Negro and the Chinese groups. This showed that the Negroes and the Chinese had more protrusive upper and lower incisors than the present sample. The mean angle of the present group and the Japanese group was nearly the same.

The mean angle of the lower incisor to occlusal plane was smallest in Caucasians and largest in Negroes. The mean angle of the North Indians, Chinese and Japanese was almost the same. The large angle of the Negroes showed a more positive relation of the lower incisor in relation to the functional or occlusal plane when compared with other ethnic groups.

The lower incisor-mandibular plane angle was smallest in Caucasians and largest in the North Indians and the Negroes. This indicated that the lower incisors were more protrusive in North Indian Hindus and Negroes in comparison with Caucasians, Chinese and Japanese.

The mean distance of upper incisor to subspinale-pogonion plane was largest in Negroes followed by Chinese, Japanese and North Indian Hindus, respectively. The mean distance was smallest in Caucasians.

A comparison of different ethnic groups revealed that the dental pattern of North Indian Hindus was significantly more protrusive in relation to the American Caucasian group. The dental pattern of Negroes and Chinese was significantly protrusive in comparison to North Indian Hindus and Caucasians. The Japanese had a denture pattern which was nearest to the North Indian Hindus.

The female sample of the present study was compared with girls from Gujrat State of India, studied by Kotak. Figure 1 shows that the skeletal patterns of both of the samples are almost identical, but the dental pattern of Gujrati

girls is more protrusive in relation to North Indian Hindu girls.

SUMMARY

This paper deals with a comparative study of the dentofacial pattern of the North Indian (Lucknow) Hindus. Fifty subjects were selected for their excellent dentofacial harmony and proportions. Cephalometric x-rays of the sample were studied by the Downs analysis. The measurements obtained were compared with the Downs norms available on other racial groups. The following results were apparent:

1. The skeletal norms obtained on the Lucknow Hindus were almost similar to the American White, but were retrusive when compared with the Chinese, Negro and Japanese.
2. The dental pattern of the Lucknow sample was more protrusive than the American White; it was retrusive as compared with the Chinese and the Negro. However, the mean values of the present study were quite similar to the Japanese.
3. Comparison of the means obtained on male and female groups of the present study revealed a protrusive skeletal pattern in the females.
4. The norms of the North Indian (Lucknow) Hindu females when compared with the norms from Gujrat (Western India) showed that Gujrati females had a more protrusive dental pattern, although the skeletal patterns of the two samples were almost identical.

The present study serves to highlight the fact that the excellence of dentofacial pattern is peculiar to its racial group. The objectives to be pursued in orthodontic treatment will naturally need to be amended accordingly.

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