

CEPHALOMETRIC CHARACTERISTICS OF INDIAN ADULTS: WITH SPECIAL REFERENCE TO DELHI NCR HOSPITAL

Dr. Sharma Rati Vedprakash¹, Dr. Mehdi Mustafa², Dr. V. Subhash³, Dr. Piyush Sharma⁴

^{1,2}Final Year Student, Department of Orthodontics and Dentofacial Orthopedics, Dental college Azamgarh, Uttar Pradesh.

³Head of Department, Department of Orthodontics and Dentofacial Orthopedics, Dental college Azamgarh, Uttar Pradesh.

⁴Lecturer, Department of Orthodontics and Dentofacial Orthopedics, Dental college Azamgarh, Uttar Pradesh.

Abstract

Objectives and Introduction

The majority of the predicted value used in Cephalometry which is used in assessing and performing the orthodontic procedure is Caucasian. In India (Delhi NCR), there is growing demand for its treatment, but there is little knowledge available in Cephalometry. So, the question arises, "Should we use Cephalometric norms from other countries?" To find the answer for this question, we have conducted a research in Delhi NCR hospitals for determining the craniofacial morphological characteristics of a group of Indian subjects.

Methodology

The methodology was conducted from the month of January 2019 to June 2019. We have conducted an observational analysis on scout view scan graphic images of patients aged 25 to 45 years at the Delhi NCR Hospitals and remaining work at dental college Azamgarh. The mean score and standard deviations of 15 Cephalometric variables were determined. To calculate the reference values, we used indicator which means 95 percent of confidence interval as the best estimator of our population measures.

Results

The total number of participants was 1200, with an average age of 31.3 years. The only differences between the sexes in Indian subjects were for SNB and SND tests, which were higher in men. The Indian population had a protrusive Dento-Alveolar system with higher average values compared to Caucasian values, with an exception of inter-incisal angles 118.3° and SND 68.8° , which showed a lower value against Steiner 131° and 79° .

Conclusion

The difference with SNB and SND measurements both between men and women in India is that the men in India are having higher SNB and SND values. Just in few measurements, sample statistics differ significantly from the Caucasian averages in India. Taking these differences into account, we were able to propose a map of Cephalometric values, which have given a clear indication of the Indian type.

KEYWORDS: Cephalometric, Indian, Steiner

I. INTRODUCTION

Cephalometric characteristics are essential for doctors to develop their treatment procedures in the field of Orthodontics.^[1] Orthodontic treatment is needed for the betterment of the patients who are suffering from any diseases related to the teeth setting or other functioning like speaking, eating, and moving their teeth.^[2] However, it is for this reason that all the doctors are trying their best to research deep into the branches of studies that relates to this aspect so that they are able to find out the typical traits that are present in their patients. Cephalometric features are different in different people coming from different ethnic groups.^[3] In India, the adult population suffer from many diseases related to teeth, and it needs a thorough understanding of Cephalometric features on the part of the Doctors.^[2] It is for this reason that the doctors have to study the Cephalometric characteristics of Indian men to bring the required improvements in their treatment methods.

Thus, it is for this reason that all the doctors have to study this matter in a detailed so that they are able to understand the methods in these aspects. However, it is important to note that there are differences among the teeth and the skeleton in relation to the heights, weights, and other body or physical features in people with relation to the ethnicity or the races or groups to which they belong.^[4] It is for this reason that the doctors have to understand the increasing demand of the greater transparency in the field of treatment methods.

Also, it is to be noted that there are differences in the body structure of people who are living in different parts of the world.^[5] In India, the body structure of people living is different from the body structure of the people living in abroad. It is for this reason that the setting of teeth and skeletal set-up in the India men are different. So, the doctors must ensure that they are taking special care in order to find out the methods through which they can work over this system.

II. METHODS AND MATERIALS

The survey had been carried out from January 2019 to June 2019. An observational analysis was conducted at the Delhi NCR hospitals. The normal values for that group are used to classify a patient, and schedule the degree of manipulation. As a result, ethnic norms must be defined for each ethnic group. The impressions were taken from the patients who came to the college. The patients' age between 25 to 45 years were selected from the pre-treatment patient records from the college. This paper is based on both primary and secondary data. All the data regarding Indian patients are collected through observational analysis conducted at Delhi NCR hospitals, while the secondary sources like data from study on Ivorians, Javan, and other ethnic races have been used for comparative studies.

Cephalometric norms for various ethnic and racial groups have been identified in various studies.^[2,6] However, there has been very little study performed on the Indian population. Lateral and Frontal methods have been followed in this research which helped in getting the accurate results for the determination of the Cephalometric details.

India is a diverse subcontinent with several ethnic subgroups, religious, and racial blend. A growing number of adult North Indians are seeking Orthodontic treatment in Delhi these days.^[6] It is important to establish Cephalometric norms for this ethnic group that could be used in clinical settings. There was a lack of a very well soft tissue Cephalometric standard for Orthognathic surgery in the Indian community, and these norms are extremely useful before surgery. As a result, the current study aimed to create comparative studies between patients from Delhi NCR (India), and the patients from other countries, such as Caucasian. After data collection, remaining work like statistical analysis and paper drafting done by scholar at department of orthodontics and dentofacial orthopedics, dental college Azamgarh.

III. CRITERIA OF INCLUSION AND EXCLUSION

(A) Inclusion

The patients who showed no problems or deformities in their skeletal orientation and teeth formations have been included. In addition to this, CT-scan reports were seen and examined so that right patients can be included in the test which will be able to show normal features with no abnormalities.

(B) Exclusion

Patients showing the maxillofacial pathology, malformation, or skeletal abnormalities identified on CT-scan at the time of the review. Any patient with unexploitable CT-scan had been excluded. This exclusion criterion was chosen so that all the patients chosen for this experiment can give the best and accurate results.

We operated CT-scan of patients at that facility. As a result, we have also included topograms of 1200 patients including 500 females and 700 males, who had completed a Craniofacial CT-scan and had all of their teeth, with a 2.3 male-to-female sex ratio. Our patients were from age between 25 to 45 years old, with an average age of 31.3 years. Any patient with unexploitable CT-scan and any case with maxillofacial pathology, malformation, or skeletal anomalies found on CT-scan at the time of the examination were omitted. Patients who had unexploitable CT-scan results had been excluded from the test.

The mean values and standard deviations of fifteen Cephalometric variables of the bony, dental, and cutaneous bases were determined using IMB SPSS Statistics 23 software. Measures of

measurement reproducibility within and between observers^[7] were assessed. We had used the average metrics with 95 percent confidence interval as the best estimator of our population measurement to calculate reference values. The threshold value for all statistical test was set at $p=0.05$. The mean values were compared using a student t-test according to Indian gender, and then between Indians and Caucasians.

(C) Determining the Cephalometric Characteristics

CT-scan was used to assess Cephalometric parameters. All CT data acquisition in 2D was done on a single computer. Subjects in the supine position have been used to collect data for each exploration performed for diagnosis. The subjects were instructed by the operator to stay still, and maintain full intercuspation of their teeth. A single operator drew the contours of CT-scan. The researchers used a computational approach involving computers including advanced Cephalometric outline tools. After selecting a sufferer image, we have used Steiner analysis to locate and mark Cephalometric points, and then used our computer mouse to take angular and linear measures from one identified point to the next. When the line was drawn from one point to another, the distances and angles appeared spontaneously. The angular measurements were confirmed using a protractor.

(D) Results

(i) Study of Cephalometric Variables of the population

In sagittal and vertical skeletal analysis, SNA and SNB angles reflect the position of the maxilla and mandible in relation to the base of the skull, and differ greatly between the sexes. By calculating ANB angle, the change in the midsagittal plane of the maxilla and mandible bone bases occur (Table 1).

Table 1: Results of the Analysis of Sagittal and Vertical Measurement

Sagittal	Male	Female	Total	p
Skeletal Measurements	Mean [IC (95%)]	Mean [IC (95%)]	Mean [IC (95%)]	
SNB(°)	83.4 [82.3-84.6]	81.7[80.5-82.9]	82.7 [81.9-83.5]	0.033*
SNA (°)	88.3 [87.2-89.5]	87.2 [86.1-88.3]	87.8 [87-88.6]	0.175
SND (°)	79.6 [78.6-80.6]	77.7 [76.5-78.9]	68.8 [68-69.6]	0.016*
ANB (°)	5.0 [4.2-5.8]	5.5 [4.7-6.2]	5.2 [4.6-5.7]	0.518
GOGN/SN (°)	15.3 [13.9-16.7]	16.2 [14.6-17.8]	15.7 [14.7-16.7]	0.397
SL (mm)	52.3 [50.2-54.4]	48.1 [46.1-50.1]	56 [43.4-68.5]	0.280

(ii) Alveolar Bases Parameters

Analysis of Dento-Dental and Dento-Skeletal ratios is shown in table 2 which reflect the mean and standard deviation of parameters related to the location of the upper and lower incisors in relation to the skeletal bases.

Table 2: Results of the analysis of Dento-Dental and Dento-Skeletal Ratios

Sagittal	MALE	FEMALE	TOTAL	P
Alveolar bases	Mean [IC (95%)]	Mean [IC (95%)]	Mean [IC (95%)]	
I-NA (mm)	5.7 [5.2-6.5]	5.5 [4.9-5.9]	5.4 [5.2-5.7]	0.497

I/NA (°)	23.4 [22.4-24.2]	23.5 [20.9-25.2]	23.5 [21.7-24.3]	0.954
i-NB(mm)	8.2 [7.3-8.5]	8.6 [7.3-8.9]	8.1 [7.3-8.4]	0.657
i/NB (°)	32.9 [30.9-34.9]	34.1[32.0-35.8]	33.4 [32.2-34.9]	0.489

(iii) Aesthetic Analysis

In analysis of soft tissue, the upper lip was measured at 5.9 mm, and the lower lip was measured at 6.5 mm for our population subjects as shown in table 3. The Cephalometric characteristics of Indian Adults are needed in order to make the treatment procedure much more useful. It is for this reason that the comparison has been done among the Caucasian or the White European population, and the Indian Adults in order to understand the differences in their structures so that greater level of transparency can be brought within the field of treatment. The variables that have been used in this study are the people from the Indian population, and also the ones from the other races in order to understand the differences that can help in bringing about the changes or the places for modification in that particular field.

It is to be noted that due to the lack of sufficient data, Orthodontic doctors are unable to find out the differences in the method of treatment that are needed for the overall medication that they need to give to their patients.^[8] However, these issues can be solved with a comparative analysis in order to understand the differences in the sizes, their structures, and the placing or positioning of the teeth within the Indian men in Delhi NCR, and that of the other population. It's important to remember that a lot of progress has already been made in the area of science and technology. It is for this reason that all doctors and nurses have to work for the overall welfare of their patients by bringing all the required materials.

Table 3: Results of the Analysis of Soft Tissue

	Male	Female	Total	
Variables of soft tissues	Mean [IC(95%)]	Mean [IC 95%)]	Mean [IC (95%)]	p
Upper Lip Le/s (mm)	+6.1 [5.4-6.5]	+5.7 [5.1-6.2]	+5.9 [5.3-6.4]	0.377
Lower Lip Le/i (mm)	+6.5 [5.8-7.3]	+6.5 [6.1-7.2]	+6.5 [6.0-7.1]	0.946

The required materials and the required or improved methods of treatment will be available only if the doctors are able to conduct a proper comparative study. This will help them to realize the ethnic differences, and also to study the dominant or biological traits that have been present in the patients' body. It is for this reason that the doctors treating patients like Indian adults in Delhi have to understand the body structure of the patients. This will help in developing the field of medicine in relation to radiography, CT scanning, and MRI. As a result, this aids in the development of novel therapies in the field of Cephalometry.

IV. DISCUSSION

The main objective of our study was to assess the craniofacial morphological characteristics of 1200 Indian subjects in Delhi NCR. This six-month study aimed at describing and defining the

Cephalometric profile of the sample, comparing Cephalometric of Indian proportions by sex, and comparing the Cephalometric profile of Indians and Caucasians. It was also our responsibility to recommend Cephalometric reference values for Indian subjects. Since the conventional approach is more complicated and time-consuming as compare to approaches that use specialized software thus a numerical method was used.

In sagittal and vertical skeletal analysis, there was a statistically significant gap between the genders of our population for the SNB and SND measurements that were higher in men. These SNA, SNB, and ANB findings were similar to those obtained in Nigeria by Ajayi^[7] the rest of the skeletal measurements were comparable between the sexes as shown in table 4. With the exception of the interincisal angles, women dental measurements were found to be superior to males without a major gender gap. Our findings for INA angular and linear measurements were similar to those found in African studies^[6,7,9] but with slightly higher values than those found in studies on the Hausa population conducted by N'dindin et al. in Ivory Coast in the year 2000^[10], and in Morocco in 2014.^[11] With the average of 8.1 mm and 33.1° for men and 8.3 mm and 34.2° for women, the values of our results were found to be superior to those of other African studies, including those found in the Ivory Coast^[10] (boys: 5 mm and 18° and girls: 7 mm and 22°), and those concerning the Hausa population^[9] due to a mean value (6.2 mm and 35.6°). This difference could be easily understood by the interracial heterogeneity.

A. Clinical Features

In sagittal and vertical skeletal analysis, for our population there is a statistically significant gap between the genders, higher for males as compare to females, for both the SNB as well as SND measurements. These findings were similar to those obtained in Nigeria by Ajayi^[7] The data were combined for review, as there were no significant variations in Cephalometric measurements between boys and girls. The majority of the skeletal measurements were similar in both sexes as shown in table 4.

Skeletal Class II malocclusion in the Javanese population at the Universitas Airlangga Dental Hospital was characterized by short mandibular length and high ANB, primarily due to a lack of SNB rather than an increase in SNA.^[12] This has helped in comprehending yet another distinction between patients from various parts of the world. With the exception of the interincisal angles, women dental measurements were found to be superior to that of males without a major gender gap. When it comes to angular and Morocco in 2012,^[13] with total of 124.65°, outperformed our sample, preferring a proclination of the upper and lower incisors in our sub-Saharan populations, as discovered by Abdoulaye M. in the Hausa population. Similarly, the interincisal angle measured by Huda et al. in the United Arab Emirates. In 2011, there was 120° for men (value similar to that found in our study of the male gender), and 121° for women (a value higher than that found in our study).

Well-balanced lips, according to Steiner, must contact a line that runs from the chin soft tissue contour to the middle of the S created by the lower edge of the nose.^[14] Beyond and behind this axis, lips appear to be protrusive and retrusive, respectively. Our research found that the upper and lower lips were protrusive in both men and women in the sample population, putting them well ahead of Steiner aesthetic rows. We speak of Biproschelia based on the findings of N'dindin et al. in the Ivory Coast in the year 2000.^[10] Nowadays, aesthetic standards reflect a generalization of western ones. However, it has to be ensured that the doctors in the eastern part

of the world +like India (considering population of Delhi NCR) are able to understand the differences present in their native patients, and then are able to find out the treatments that will be best for them. Indian participants had upper lip measurements of 6 mm and lower lip measurements of 6.7 mm. As a result, when opposed to Caucasian samples, Indian adults have a higher propensity to have a protrusive lip profile. Assor, who performed a report on the effect of ethnicity on aesthetic assessment in ODF, came to the same conclusion. According to the current result, there are some fundamental differences in the craniofacial system in Caucasians as opposed to Steiner norms. These findings could help Indians to get the right diagnosis and orthodontic treatment. The findings of our study also support the idea that a single facial aesthetics norm should not be extended to all racial and ethnic groups. In comparison to the Caucasian samples, the Indian, African, and other ethnic samples showed the following distinctions and similarities.

V. CONCLUSION

The mean values of our sample parameters were increased in dental and skeletal parameters, except for the interincisal angle that showed a smaller value. Thus, we can say that, like other Africans, they have a tendency to prognathism of both jaws with respect to measures of SNA and SNB. This should be kept in mind while making the skeletal diagnostic of Indian subjects. Also, the transposition of the reference values established by Steiner depicted that Caucasian population and Indian population (Delhi/NCR) does not seem suitable. Comparisons of our sample with other ethnic groups highlighted the need to develop separate standards knowing that ethnicity, and even a racial issue along with its Cephalometric characteristics plays an important role in the planning of orthodontic treatment.

Table 4: Study on the Impact of Ethnicity in Aesthetic Evaluation

Measurements	Indian	Javan	Haussa	Ivoirian	Steiner	Indiens
SNA (°)	87.5	82.34	86.2	85.5	82	84.3
SNB (°)	82.4	75.91	82.1	81.2	80	82.8
SND (°)	68.8		78.3		79	79
ANB (°)	5.1	6.42	4.1	4.3	2.5	2
I/i (°)	118.3		114.1		131	122
I/NA (°)	22.3		27.4		22	28
I/NA mm	5.3		4.5		4	8
i/NB (°)	33.6		35.6		25	28
i/NB mm	8.1		6.2		4	6.5
Occ/SN (°)	15.4		15.6		14	12
GOGN/SN (°)	30.7		30.6		32	15.7
SL (mm)	57		40.7		51	56
SE (mm)	21.3				22	

REFERENCES

1. Juneja M, Garg P, Kaur R, Manocha P, Prateek, Batra S, Singh P, Singh S, Jindal P. A review on cephalometric landmark detection techniques. *Biomed Signal Process Control*. 2021;66(102486):102486.
2. Achmad H, Armedina RN, Timokhina T, Goncharov VV, Sitanaya R, Riyanti E. Literature review: Problems of dental and oral health primary school children. *Indian j forensic med toxicol*. 2021;15(2):4117–24.
3. Perović T, Blažej Z. Male and female characteristics of facial soft tissue thickness in different orthodontic malocclusions evaluated by cephalometric radiography. *Med SciMonit*. 2018;24:3415–24.
4. Nasim DR, Ramakrishnan DR, Alkahtani DZM, Ganapathy DS, Vedam DV, Saluja P. A cross-sectional study to establish soft tissue cephalometric norms for orthognathic surgery in Kerala population. *Eur J Molecul Clinic Med*. 2021;8(1):863–74.
5. Dhillon PK, Mathur P, Nandakumar A, Fitzmaurice C, Kumar GA, Mehrotra R, Shukla DK, Rath GK, Gupta PC, Swaminathan R, Thakur JS, et al. The burden of cancers and their variations across the states of India: the Global Burden of Disease Study 1990-2016. *Lancet Oncol*. 2018;19(10):1289–306.
6. Drummond RA. A determination of cephalometric norms for the Negro race. *Am J Orthod*. 1968;54(9):670–82.
7. Ajayi EO. Cephalometric norms of Nigerian children. *Am J OrthodDentofacialOrthop*. 2005;128(5):653–6.
8. Kalha AS, Latif A, Govardhan SN. Soft-tissue cephalometric norms in a South Indian ethnic population. *Am J OrthodDentofacialOrthop*. 2008;133(6):876–81.
9. Omotoso DR, Olanrewaju AJ, Okwuonu UC, Adagboyin O, Bienonwu EO. Morphometric study of cephalo-facial indices among Bini children in southern Nigeria. *Anat j Afr*. 2019;8(2):1580–5.
10. N'Dindin-Guinan BA, Djaha K, Aka A, Faure J, Roux H. Evaluation of the facial esthetics in an Ivory Coast population. *Odontostomatol Trop*. 2000;23(91):15–22.
11. Mahamadou A. Cephalometric standards in two subSaharan populations shrugged and Somali residents in Morocco. [Morocco]: University Hassan II-Ain Chock Casablanca; 2014.
12. Ardani IGAW, Sanjaya ML, Sjamsudin J. Cephalometric characteristic of skeletal Class II malocclusion in Javanese Population at UniversitasAirlangga Dental Hospital. *ContempClin Dent*. 2018;9(Suppl 2):S342–6.
13. Ousehal L, Lazrak L, Chafii A. Cephalometric norms for a Moroccan population. *IntOrthod*. 2012;10(1):122–34.
14. Steiner CC. CephalometricsIn Clinical Practice. *Angle Orthod*. 1959;29(1):8–29.