

# Comparison of cephalometric norms of caucasians and non-caucasians: A forensic aid in ethnic determination

Cephalometrics is a reliable and reproducible diagnostic modality most commonly used in clinical and research orthodontics. It was introduced by Broadbent and Hofrath in 1931 in the United States and Germany, respectively. The study of craniofacial relations and variations using cephalometrics amongst various ethnic groups has long been a subject of investigation in forensic sciences. Besides its application in the planning of orthodontic treatment and orthognathic surgeries, cephalometric analysis also finds application in the evaluation of ethnic groups in forensics. The proper identification of a decedent is not only important for humanitarian and emotional reasons for the next of kin but also for legal and administrative purposes. Numerous cephalometric studies compare the dentofacial characteristics of Caucasians and non-Caucasians like Nepalese, Japanese, Indo-Aryans, Chinese, Africans, and Afro-Americans. A few of them have been reviewed in this article.

## Steiner's cephalometric norms for the Nepalese population

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The Steiner numerical analysis, which was developed in the 1950s, suggests a series of cephalometric measurements not only to diagnose the problem but also to provide guidelines for treatment planning based on the prediction of changes that take place as a result of growth and/or orthodontic therapy.

Variations in morphology exist between different ethnic groups or populations. A cross-sectional study was carried out using lateral cephalograms obtained from 120 natural-born ethnic Nepalese subjects to establish

cephalometric norms for the Mongoloid and Indo-Aryan ethnic groups within the Nepalese population based on Steiner analysis, to investigate the gender and inter-racial differences in the skeletal, dental, and soft tissue relationships, and to determine the racial differences in cephalometric measurements in Nepalese, Caucasian, and other populations.

Lateral cephalograms of 120 Nepalese subjects aged between 16 and 21 years with class I normal occlusion and balanced facial aesthetics were selected. The cephalometric variables were measured. An independent one-sample t-test was used to compare Steiner's ideal values with mean values of Indo-Aryan Nepalese, and an independent t-test was used to compare the mean values of Japanese population with Mongoloid Nepalese population and those of Mongoloids with Aryans.

The study results showed that the Nepalese Indo-Aryan sample had a shorter anterior cranial base, longer posterior cranial base, more prognathic maxilla, a more anteriorly placed mandibular base, more protrusive upper incisors, and more protrusive lips when compared with Caucasian ideal values. The mandible was most retrusive in the Japanese population followed by Korean females and Israelis, and most protrusive in the Nepalese population followed by Caucasian ideal values. The Negroids had the most protrusive dentition and the Caucasians had the most retrusive dentition.

Differences in the cephalometric values existed between the two ethnic groups in Nepal, as well as between the Nepalese sample and published Caucasian and Japanese norms. The norms published in this article are useful in planning orthodontic treatment in Mongoloid and Indo-Aryan individuals.

## Craniofacial characteristics of Caucasian and Afro-Caucasian Brazilian subjects with normal occlusion

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The differences in cephalometric traits between a homogeneous racial group and an inter-racial blending group have been evaluated in this article. The inter-racial blending of Africans and Caucasians shows unique characteristics in their descendants. These differences could play a role in treatment planning. The 2000 Brazilian demographic census showed that 53.74% of the national population was Caucasian, 6.21% was composed of African subjects, and 38.45% were Afro-Caucasian subjects. One of the most common inter-racial blendings occurs between Caucasian and African subjects. Each of these two basic ethnic groups has different facial characteristics. The Africans have greater bimaxillary protrusion than Caucasian subjects.

The objective of this study was to compare the skeletal, dental, and soft tissue characteristics of Caucasian and Afro-Caucasian Brazilian subjects with normal occlusion and to evaluate sexual dimorphism within the groups. The sample comprised lateral cephalograms of untreated normal occlusion subjects, divided into two groups. Group 1 included 40 Caucasian subjects (20 of each sex), with a mean age of 13.02 years; group 2 included 40 Afro-Caucasian subjects (20 of each sex), with a mean age of 13.02 years. Groups 1 and 2 and males and females within each group were compared with t-tests.

The Afro-Caucasian subjects inherited an increased lower anterior facial height (LAFH: linear distance between articulare and menton) from the Caucasians because African subjects usually have smaller LAFH than Caucasian subjects. The upper posterior facial height (UPFH: linear distance between sella and articulare) was larger in the Caucasian subjects than in the Afro-Caucasian subjects, which is similar to the African subjects. The Afro-Caucasian subjects had more proclined and protruded maxillary and mandibular incisors, more protruded upper and lower lips, and a smaller nasolabial angle than the Caucasian subjects. These characteristics show that Afro-Caucasian subjects have dental and soft tissue components similar to the African ancestors. The Afro-Caucasian females had lesser mandibular protrusion and smaller total posterior facial height (TPFH: linear distance between sella and gonion) and UPFH than males. It is common among the African ancestors for males to have a greater mandibular protrusion than females. The literature also shows that African female subjects have smaller posterior vertical dimensions in the face than males.

Thus it was concluded that Brazilian Afro-Caucasian subjects presented greater maxillary protrusion, smaller upper anterior face height (UAFH) and LAFH, larger UPFH, and greater maxillary and mandibular dentoalveolar protrusion as well as soft tissue protrusion compared to Caucasian subjects.

## Chinese norms of McNamara's cephalometric analysis

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McNamara's cephalometric analysis combines the anterior reference plane (a plane perpendicular to the Frankfort horizontal through the nasion) described by Burstone *et al.* and a description of the length of the jaws and their relationship as given by Harvold. It is a method of cephalometric analysis that is sensitive not only to the position of teeth within a given bone, but also to the inter-relationship between jaw elements and cranial base structures.

Cephalometric norms for Chinese population were established using McNamara's cephalometric analysis and compared with those of Caucasian subjects. Lateral cephalometric radiographs of a random sample of 200 male and 205 female 12-year-old southern Chinese children and of a sample of 43 male and 43 female 12-year-old British Caucasian children in Hong Kong were taken. Initially, the radiographs were traced manually and then rechecked by digitization and application of the program CASSOS (Soft Enable Technology Limited, Hong Kong, PRC).

The mandibular plane angle, SNA [angle between SN (sella, nasion) and NA (nasion, point A)], maxillomandibular difference, upper incisor to point A vertical, and lower incisor to A-Po (A-pogonion) line were larger in the Chinese than in the Caucasian subjects. On the other hand, effective midface length, facial axis angle, and pogonion-to-nasion perpendicular were larger in the Caucasians compared to the Chinese subjects.

Statistically significant ethnic differences between the Caucasians and Chinese subjects were evident from the standard deviation scores of the cephalometric analysis which can henceforth serve as a useful tool in treatment planning.

## Comparison of cephalometric norms between Japanese and Caucasian adults in antero-posterior and vertical dimension

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*Eur J Orthodont 2007;29:493-9*

Cephalometric norms between Japanese and Caucasians were compared and studied for clinical applications in treatment planning. The specific objective of the study was to determine Japanese cephalometric norms in the antero-posterior and vertical dimension, and to test the hypothesis that there are racial differences in cephalometric measurements between Japanese and Caucasian norms. Radiographs were obtained from 25 healthy Japanese

males (aged 25.1±2.7 years) and 24 healthy Japanese females (aged 23.6±1.3 years). Inclusion criteria were an ANB angle between 2° and 5°, a normal occlusion with minor or no crowding, presence of all teeth except third molars, no previous orthodontic treatment, and no prosthetic replacement of teeth. Two angular and five linear measurements were constructed for the skeletal hard tissue analysis, one angular and six linear measurements for the dental hard tissue analysis, and two angular and seven linear measurements for the soft tissue analysis. The mean and standard deviations for the hard and soft tissue measurements were determined for each gender. Unpaired t-tests were used to determine the mean differences for each cephalometric measurement between the Japanese and the Caucasians.

It was found that the Japanese subjects had a significantly more retruded chin position, typically protruding mandibular incisors, and protruded lip positions compared with the Caucasian norms. In the vertical dimension, the Japanese had a significantly steeper mandibular plane. The Japanese females had a significantly larger lower face height and increased dental height.

### Comparison of dentoalveolar protrusion values in Moroccans and other populations

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The relationship of the skeletal and dental functional units of the face is important to establish the horizontal and vertical positions of the jaw units. Most of the cephalometric analyses include norms to assess the antero-posterior (A-P) plane. Vertical linear measurements are required to evaluate the anterior open bite and deep bite subjects.

Dentofacial characteristics of many ethnic groups have been reviewed by various investigators for orthodontic purposes. The role of bimaxillary protrusion in facial aesthetics and occlusion has been studied in Afro-Americans, Asians, and other communities. But similar studies in Arabs and Moroccans are rare.

This article aims to evaluate bimaxillary protrusion among Moroccans and to compare the Moroccan population with other Arabic, Caucasian, and Mediterranean populations. Cephalometric radiographs of 102 Moroccan adult university students (73 females and 29 males, mean age: 21 years 6 months ± 1 year 6 months) with a normal

occlusion were traced. The study samples were chosen from the northern population of Morocco. Fifteen measurements concerning the upper and lower incisors, upper and lower lips, and the Frankfort to mandibular plane angle were assessed. Statistical analysis of the data was undertaken using independent t-tests.

The study results showed that bimaxillary protrusion was more in the Moroccans than in the Caucasians, further emphasizing the significance of cephalometric analyses in treatment planning.

### Cephalometric norms for central indian population using burstone and legan analysis

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Several methods of cephalometric analysis have been used to show the normality of dentofacial and skeletal patterns. A large number of studies have been conducted to determine the skeletal and dentofacial patterns of Caucasians, black Americans, black Africans, and other ethnic groups. Hence, this article employed a specialized cephalometric appraisal for orthognathic surgery, the Burgstone and Legan analysis, to study the cephalometric norms of the Central Indian population.

Lateral cephalometric radiographs of 76 Central Indian adults (38 male and 38 females) with class I normal occlusion were evaluated for hard and soft tissue measurements and were compared with the published reports of Caucasian adults. The landmarks were analyzed with Burgstone and Legan's cephalometric norms and manual tracing was done on 0.003 lead acetate tracing sheets. The statistical analysis was performed using Z-test.

Significant differences in the dentofacial pattern were appreciated in this study. The Central Indian females exhibited a greater posterior cranial base, greater mandibular protrusion, retrusive chin, greater upper anterior facial height, greater upper posterior facial height, greater maxillary lip length, greater ramal length, greater mandibular body length, reduced chin length, and greater inclination of the lower incisors than the Caucasian females.

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