ARE THE RICKETTS NORMS ADEQUATE FOR MIDDLE EUROPEAN ADOLESCENTS?

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REZUMAT

Scopul studiului: De a evalua statusul scheletal specific adolescenților maghiari cu tulburări de ocluzie și de a verifica existența diferențelor cefalometrice semnificative între aceste măsurători și standardele acceptate pentru populația caucaziană. **Material și metode:** studiul a fost efectuat utilizând radiografiile standardizate cefalometrice a 500 de copii (217 băieți și 283 fete), înregistrați cu malocluzie diagnosticată, prezentând dentiție timpurie permanentă și dentiție permanentă și care nu au fost tratați ortodontic. Vârsta subiecților a variat între 12 ani și 5 luni și 18 ani și 3 luni (media 15 ani și 3 luni). S-a efectuat analiza cefalometrică asistată de computer. Cefalogramele laterale au fost analizate de același sistem digital, iar indexurile structurilor cranio-faciale au fost analizate prin metoda Ricketts. Analiza statistică fundamentală pentru variabilele cefalometrice a fost obținută cu ajutorului programului SPSS 11.0 for Windows. **Rezultate și discuții:** Din 30 de parametri cefalometrici, studiul a urmărit valorile convexității faciale, axul facial, deflexia cranio-facială, unghiul mandibular și unghiul conic. Deflecția cranio-facială a variat între 16,00 și 36,20^0, cu o medie de 26,89^0. Convexitatea facială a variat de la -10,6 la 10,7 mm, cu o medie de 0,1098. Unghiul axului facial a prezentat un minim de 76.1^0 și un maxim de 101,8^0, cu o medie de 89,44^0. Unghiul mandibular a prezentat o medie de 20,5^0 rezultată dintr-un minim de 0,2^0 și un maxim de 53.7^0. Această valoare a fost considerată ca fiind redusă, în comparație cu valoarea normală de 27,2 ± 4.5^0. **Concluzie:** Studiul a arătat că măsurătorile au fost normale în procentaj mare, prin comparație cu datele normative considerate normale de Ricketts. Totuși, unghiul mandibular a prezentat o valoare medie scăzută.

Cuvinte cheie: cefalometrie, valori Ricketts, norme caucaziene

ABSTRACT

Aim of the study: Our aim was to evaluate the skeletal status particular to Hungarian adolescents with malocclusion and to determine whether significant cephalometric differences exist between this measurements and accepted standards for Caucasian population. **Material and methods:** The study was carried out using standardized digital cephalometric radiographs of 500 children (217 males and 283 females) - recorded with diagnosed malocclusion - having early permanent and permanent dentition and without any previous orthodontical treatment. Subjects age ranged between 12 years and 5 months and 18 years and 3 months (mean age 15 years and 3 months). A computer-aided cephalometric analysis was performed. The lateral cephalograms were measured by the same computer system and the indexes of craniofacial structures were analysed by Ricketts' method. The basic statistical analyses for different cephalometric variables were obtained using the SPSS 11.0 for Windows database software. **Results and discussion:** Among 30 cephalometric parameters, we followed the values of facial convexity - facial axis, cranio-facial deflexion, mandibular angle and conical angle. Cranio-facial deflection varied between 16.00 and 36.20^0 with a mean of 26.89^0. The facial convexity ranged from -10.6 to 10.7 mm with a mean of 0.1098. Facial axis angle presented a minimum of 76.1 and a maximum of 101.8^0, with a 89.44 mean. The mandibular angle had a mean of 20.5^0, resulting from the range of 0.2^0 (minimum) and 53.7^0 (maximum). This was a decreased value regarding to the normal of 27.2 ± 4.5^0. **Conclusion:** The study showed that the measurements were in highly percentage normal when compared with their normative data established as normal values according to Ricketts. However, the mandibular angle showed a decreased mean value.

Key Words: cephalometry, Ricketts values, Caucasian norms

INTRODUCTION

Cephalometric standards from various ethnic groups have been developed since Broadbent introduced cephalometrics in 1931. The importance of cephalometry derives from its roles, ranging from the study of the cranio-facial complex to the development of cephalometric norms for diagnosis, management and outcome assessment of orthodontic treatment.

Cephalometric standards have been derived from different ethnic groups and are reported in the literature, in case of Caucasians (Downs, 1948), Koreans (Suh, 1967), Japanese (Mitani, 1980), North Indians (Nanda and Nanda, 1969), Afro-Carribean (Drummond, 1968).[1]

Differences among races are noted, as well as among Caucasians.[2-8] Differences within the same ethnic group have also been demonstrated, even in case of closely related and homogeneous ethnic groups as the Scandinavians.[9,10] Most cephalometric standards published have focused on describing changes

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during childhood and through adolescence, which is the age at which patients usually seek orthodontic treatment.[8,11-15]

Applicability of the different cephalometric norms was questioned for several times due to the above mentioned criteria.

AIM OF THE STUDY

The aim of this study was to evaluate the skeletal status particular to Hungarian adolescents with malocclusion and to whether significant cephalometric differences exist between this measurements and accepted standards for Caucasian population.

The null hypothesis was that Ricketts norms are not applicable to Hungarian adolescent population.

SETTING AND SAMPLE POPULATION

The material used in this investigation was collected at the Department of Orthodontics and Orofacial Orthopaedics of Heim Pal Children's Hospital, Budapest, Hungary. The study was carried out using standardized digital cephalometric radiographs of 500 adolescents (217 males and 283 females) – recorded with diagnosed malocclusion- having early permanent and permanent dentition, majority of teeth present except third molars.[16,17] Subject's age ranged between 12 years and 5 months and 18 years and 3 months (mean age 15 years and 3 months). The children had not undergone any previous orthodontic treatment or maxillofacial surgery, no history of facial trauma.

MATERIALS AND METHODS

Trained radiographers using a radiographic unit took cephalometric radiographs. The focus-median plane distance was 150 cm and the focus-film distance 15 cm, producing an enlargement of the midline structures.

Linear measurements are often given in millimeters, without paying attention to the magnification factor, which usually varies between 5 and 14%, mainly due to variation in the focus-object distance. The magnification was calculated to be 10% for the mid-sagittal structures. In contrast to distances, angular measurements are not sensitive to the changes in magnification of the cephalometric radiograph.[18]

Right lateral cephalograms were taken with the subjects in an upright position, with the patient's Frankfurt horizontal plane parallel to the floor and the spine slightly extended. The film was exposed with the patient in maximum intercuspation and lips in repose.

A computer-aided cephalometric analysis was performed according to Ricketts by the computer program FR Win 5.0 (Fernroentgen und Modell-analyse). Each lateral cephalograms were traced and digitised, and differences between cephalometric measurements were analysed with completely randomised t tests.[19]

Tracing the radiographs, left-to-right outlines will not be perfectly superposed sometime, due to facial asymmetry, greater magnification of the image on the side farthest from the film, imperfect positioning of the patient in the cephalostat. Therefore, if differences between outlines greater than 0.5 arose, the respective radiographs were excluded.

The method error was used for control. The duplicate determination of cephalometric landmarks for several radiographs was used, chosen at random and re-traced on a separate session under identical conditions.

The method error was assessed using Dahlberg`s (1940) formula:

$$ME = \sqrt{(\Sigma d^2 / 2n)}$$

where d represents the difference in the value of the repeated readings and n is the number of repeated readings.[20]

The systematic error was estimated using a one-sample t-test, as suggested by Houston (1983). Descriptive statistics were generated, including the mean; standard deviation, the maximum and the minimum values were computed for each variable, using Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA). The variance of distribution was compared using the test of skewness and kurtosis.

RESULTS AND DISCUSSION

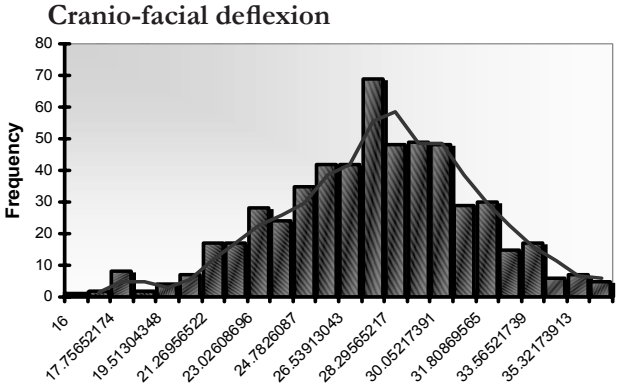

Figure 1. Cranio-facial deflexion.

The cranio-facial deflexion angle varied between 16.00º and 37.6º, with a mean of 26.92º. The range was 21.6º. The close value for median and mode followed a normal distribution of the sample. Due to skewness values, the histogram showed slightly left asymmetry with an accentuated peakness. Compared with similar data, the present results indicated similar values.

Facial axis angle

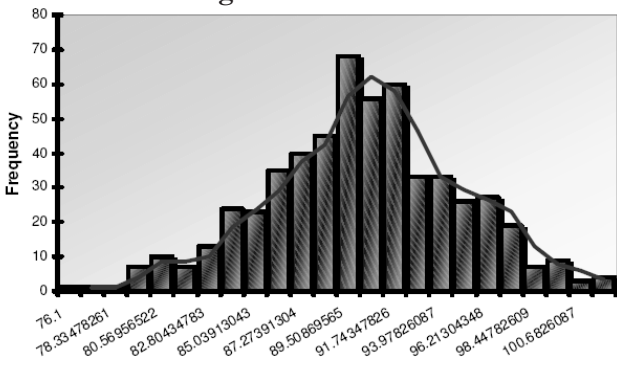

Figure 2. Facial axis.

The facial axis angle height presented a minimum of 76.1º and a maximum of 101.5º, with an 89.5º mean, these being normal average values, similar to standards. A left asymmetric histogram with a weakly peaked curve proved more frequently higher values then the median, but still close to the standards. However, the range was wider than expected, and the maximal value is noticeable.

Facial convexity

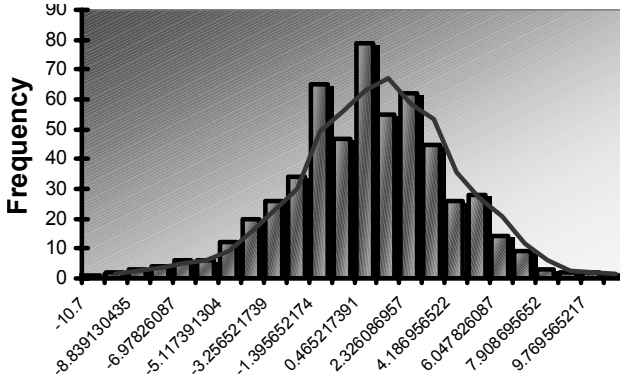

Figure 3. Facial convexity.

The facial convexity angle ranged from -10 to 13.9 mm with a mean of 0.2474. Having a median of 0.1 mm for convexity of the face (considerably less than the standard 0.8 mm), this value should be included in the range of clinical deviation. With almost the same median and mode values it should be an ideal, normal distribution, but a peaked, very slight asymmetry of histogram leads towards slightly smaller values. Similarity to expected values can be seen in spite of a wide range and smaller values for convexity.[21]

Mandibular plane angle

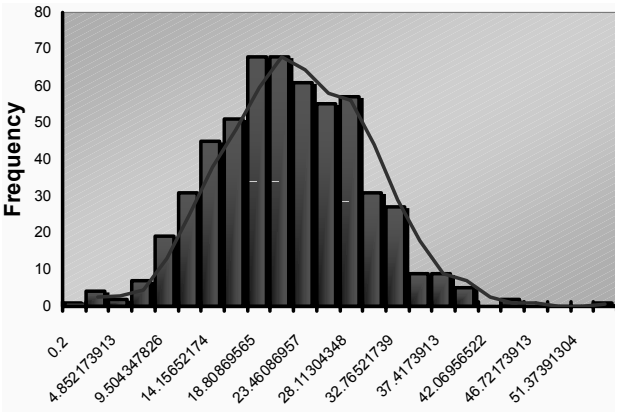

Figure 4. Mandibular plane angle.

The mandibular angle had a mean of 20.89º, resulting from the range of 2.2º and 53.7º. This represented a decreased value regarding to the normal of 27.2º+/-4.5º. According to Ricketts norms, the SD for the normal of 26º is 4º. Smaller mean values for mandibular angle have resulted in this study. Having a smaller median, most of the values were at the lower limit of expectations. The peaked diagram showed a right asymmetry (Mo < Me < Mean).[21]

Conical angle

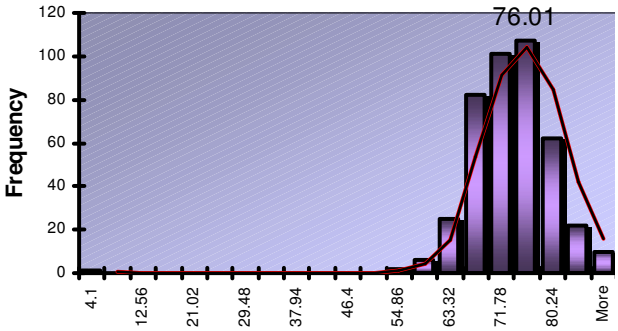

Figure 5. Conical angle.

The conical angle showed a 71.54º mean, range being 84.6º. Average values were higher than expected but still not so far from the upper limit of the normal values.[22] Standard deviation was larger in our findings. The negative skewness values lead towards left asymmetry. The normality of the spot was verified by the control-formulas for each topic, giving normal results (0.9 Me/Mean < 1.1, 3s < Mean).

CONCLUSION

The null hypothesis - that the norms established

by Ricketts would not be applicable for Hungarian adolescents - was rejected. The study showed that the measurements were in high similarity with the normal values according to Ricketts, established for Caucasians, in spite of diagnosed malocclusion and need of treatment. Further investigations into this area are required and are in a due course.

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