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Mandibular Ramus Height in Different Age Periods According to Cephalometry

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ABSTRACT: The aim of the study was to study the ramus height in both genders in different age periods using cephalometry. The material for the study was 128 lateral cephalograms. Cephalograms covered the following age periods: 2nd childhood (n = 40, boys of 8-12 years old: 21; girls of 8-11 years old: 19); puberty (n = 28, boys of 13-16 years old: 8; girls of 12-15 years old: 20); adolescence (n = 30, boys of 17-21 years old: 10; girls of 16-20 years old: 20); and 1st adulthood (n = 30, men of 22-35 years old: 14; women of 21-35 years old: 16). The results of the study showed that in each of the age periods (puberty, adolescence, and 1st adulthood), the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in males. In adolescence and 1st adulthood, the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in females. Also, in puberty, the ramus height values are statistically significantly different from those values in 2nd childhood (Pt<0.016). The study also found a statistically significant difference in the ramus height in 1st adulthood from the value of the specified parameter in puberty (Pt<0.022). A statistically significant difference between the male and female groups was not found.

KEY WORDS: ramus height, mandible, cephalometry, age periods.

I. INTRODUCTION

Understanding the natural changes that occur throughout life in the craniofacial complex is extremely important. The mandible is the hardest and most durable bone of the skull, showing a high degree of sexual dimorphism. This is especially true for the ramus of the mandible, which is subjected to more stress than any other bone of the skull due to its participation in chewing. As an interface between the mandible and the skull, the mandibular ramus is of functional importance, and its morphology is considered informative for taxonomic and phylogenetic analysis. Anatomically or completely restoring the ramus height is difficult, even with surgical treatment [1–4].

A number of studies are devoted to the use of the mandible parameters, in particular the ramus height, in the gender and age identification of the skull. According to [5], measurements of the mandibular ramus can be a useful tool for sex determination and can be an important tool in forensics, especially when the mandible is damaged or partially preserved. [6] indicates, that a study of mandibular ramus measurements using an orthopantomograph demonstrates compelling evidence that the ramus can be used for gender determination in forensic examinations.

All measured mandibular parameters were statistically significantly higher in males than in females (P<0.001). Morphometric analysis of the mandibular ramus using a digital orthopantomogram showed high sexual dimorphism. Of seven measurements, the most accurate estimates of age at death were derived from the maximum height of the mandibular ramus. This discovery could potentially help researchers determine the age at which infants die [7–8].

Anthropometric examination of the mandible from anteroposterior and lateral radiographs of persons over 70 years of age with both dentate and edentate mandibles, but without any mandibular dysmorphosis, was performed to demonstrate the differences that exist between dentate and edentate mandibles. There was no significant difference in mandibular ramus height [9].

Additional studies are required in the study of the morphometric parameters of the mandible. As pointed out by [10], based on the anthropological study of the mandibles, the metrical characteristics of the mandible differ between races. At the same time, it is extremely important to use the latest methods in research, which can provide the most accurate morphometric data. The latter are especially important when planning surgical interventions and orthodontic manipulations. An analysis of the literature of recent years indicates a tendency to use the methods of computed tomography and cephalometry in studies of the mandible.

[11] studied mandibular ramus height and condyle distance asymmetries in individuals with different facial growth patterns using cone-beam computed tomography. An observational cross-sectional study using CBCT was performed on 159 patients (mean age 26.36 ± 5.32 years). The study did not cover a large age range.

Ramus height, mandibular body height, and mandibular body length decreased significantly with age in both genders, while the mandibular angle increased significantly in both genders with age. These results suggest that the osseous elements of the mandible change significantly with age in both genders and that these changes, combined with soft tissue changes, result in an aged lower third of the face [12].

Significantly increased investigations of the mandible using cephalometry [13-15]. However, given the importance of the ramus height in the context of the importance of the ramus as a place of attachment of the masticatory muscles and the presence of the mandibular canal as the main pathway for innervation and vascularization of the elements of the dento-alveolar system of the lower jaw, the accuracy of morphometric data is extremely important. Based on this, we undertook a study using cephalometry on a wide range of material, covering both genders and the age range from 2nd childhood to 1st adulthood, inclusive.

The aim of the study was to study the ramus height in both genders in different age periods using cephalometry.

II. MATERIALS AND RESEARCH METHODS.

The material for the study was 128 lateral cephalograms. Cephalograms covered the following age periods: 2nd childhood (n = 40, boys of 8-12 years old: 21; girls of 8-11 years old: 19); puberty (n = 28, boys of 13-16 years old: 8; girls of 12-15 years old: 20); adolescence (n = 30, boys of 17-21 years old: 10; girls of 16-20 years old: 20); and 1st adulthood (n = 30, men of 22-35 years old: 14; women of 21-35 years old: 16).

Measurements were taken using the Jarabak cephalometric analysis method (Jarabak & Fizzel, 1972) using the WEBCEPH (Web-based Orthodontic and Orthognathic Platform) software. The program "IBM Statistics SPSS-26" was used for statistical analysis; the statistical significance of differences between groups was determined using the t-Student-Bonferroni, F-Fisher, and Mann-Whitney Mann-Whitney U tests. The limit of statistical significance was taken as p = 0.050.

III. RESEARCH RESULTS

Based on the results obtained using the Jarabak cephalometric analysis for each age period, the arithmetic mean (M), the Median (Me), and quartiles (Q1-Persentile 25 and Q3-Persentile 75) were calculated. Table 1 shows the ramus height indicators for the studied age periods in males.

Table 1. The ramus height indicators in males.

.Age periods				
	2nd childhood	Puberty	Adolescence	1st adulthood
Mean	38.4	46.6	48.9	50.5
Median	37.7	46.2	49.1	50.0
Percentile 25	35.8	44.5	45.7	46.6
Percentile 75	39.2	50.0	51.5	55.5

The results of the study showed that in each of the age periods (puberty, adolescence, and 1st adulthood), the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in males.
Table 2 shows the ramus height indicators for the studied age periods in females.

Table 2. The ramus height indicators in females.

Age periods	2nd childhood	Puberty	Adolescence	1st adulthood
Mean	39.3	44.3	46.2	49.4
Median	38.0	43.2	46.1	48.9
Percentile 25	35.7	41.4	42.0	45.8
Percentile 75	40.3	46.3	50.2	53.9

The results of the study showed that in adolescence and 1st adulthood, the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in females. Also, in puberty, the ramus height values are statistically significantly different from those values in 2nd childhood (Pt<0.016). The study also found a statistically significant difference in the ramus height in 1st adulthood from the value of the specified parameter in puberty (Pt<0.022).

A statistically significant difference between the male and female groups was not found. Thus, in 2nd childhood and puberty, the difference is not statistically significant using the F-Fisher and Mann-Whitney Mann-Whitney U tests. For the 2nd childhood age period, PF = 0.545; PU = 0.735. In puberty, as noted, the difference in the ramus height values was also not statistically significant (PF = 0.198; PU = 0.115). In adolescence and 1st adulthood, these differences are also not statistically significant (in adolescence, PF = 0.198, PU = 0.253, and in 1st adulthood, PF = 0.557; PU = 0.454)

IV. DISCUSSION.

The linear and angular dimensions of the mandible remain areas of attention in both theoretical and clinical studies. The presence or absence of teeth also affects these dimensions. According to [1], subjects with multiple tooth losses showed greater increases in mandibular ramus height. But the study [9] indicates that there was no significant difference in mandibular ramus height between dentate and edentate mandibles. In the literature reviewed by us, specific age periods were mainly studied. So, in the study [16], the subject of investigation was the age range of 8–12 years. The authors found that there was a high prevalence of both dimensional and angular mandibular asymmetries in the studied population.

The study [17] touched on the adolescent age period, indicating that there are large individual differences in the linear growth of the mandible. In the study of the ramus height, much attention is paid to dental panoramic radiography. [18] using this method found that according to the angle of the cranial base (Sella-Nasion)-mandibular plane (SN-MP), patients were divided into three groups: normal angle, low angle, and high angle. People with a high angle have a lower ramus height and less condylar morphology than people with a normal angle and a lower angle. In addition, as the SN-MP angle increases, the size of the condyle and the height of the ramus decrease, which is a clinically important finding.

As mentioned above, in recent years, the cephalometry method has been widely used to study the parameters of the mandible, in particular the ramus height [13-15]. According to [7], all measured mandibular parameters were statistically significantly higher in males than in females (P<0.001). We did not determine a statistically significant difference between the male and female age groups, but along with that, in each of the age periods (puberty, adolescence, and 1st adulthood), the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in males. We also established that in adolescence and 1st adulthood, the ramus height values are statistically significantly different from the 2nd childhood values of the specified parameter using the t-Student-Bonferroni test (Pt<0.001) in females. Also, in puberty, the ramus height values are statistically significantly different from those values in 2nd childhood (Pt<0.016). The study also found a statistically significant difference in the ramus height in 1st adulthood from the value of the specified parameter in puberty (Pt<0.022).

V. CONCLUSION.

The study of the ramus height has both theoretical and applied significance. The use of cephalometry in several age groups and both genders can be considered the most acceptable.

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