MAJOR TELERENTHENGOGRAM INDICATORS IN PEOPLE WITH VARIOUS GROWTH TYPES OF FACIAL AREA

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ABSTRACT — The results of the study and the comparison of the head lateral teleroentgenogram, involving 292 persons (both sexes) in their first adulthood period, featuring physiological occlusion of permanent teeth, helped identify the occurrence of different growth types of the facial area of the head (vertical, neutral, horizontal). The analysis of lateral teleroentgenograms included evaluation of the mandible angle size, the total Bjork angle, the ration between the posterior and the anterior face height, the Ricketts face angle, the angle between the occlusal and mandibular planes, and the angle shaped by the skull base plane and the mandibular plane. The obtained measurements allow stating that most people with physiological occlusion reveal the neutral type of the facial part growth (61.99 ± 2.84%), while the horizontal and the vertical types of growth were observed in 30.48 ± 2.69% and 7. 53 ± 1.55% of the total number of the participants, respectively.

KEYWORDS — physiological occlusion; facial area of head; teleroentgenogram; jaw growth type.

INTRODUCTION

The issues of the facial skull growth have been the focus of experts' attention for the last four decades. One of the criteria for assessing the maxillofacial area status is the jaw growth. The type of the jaw growth is recommended to be evaluated based on the data obtained through the head teleroentgenogram examination in the lateral projection [4, 11, 17, 25, 28, 30, 34].

Currently, there are three major types of jaw growth known – neutral, horizontal and vertical. The growth type is determined subject to several interdependent parameters, including the total Bjork angle, the ratio of the face front height to the rear height, the lower gonial angle, the Ricketts face angle. Comparing the obtained actual values with the tabulated values allows estimating the type of the jaw growth [5, 12, 26, 32, 37, 40].

Clinical orthodontics recommends evaluating the jaw growth type while selecting treatment for occlusion disturbances in various directions [1, 3, 7, 9, 14, 18, 21, 23, 27, 31].

The neutral type of jaw growth is considered the most favorable one for treating occlusion anomalies. Treating mesial occlusion and deep occlusion at the vertical growth type is preferable than treating distal occlusion. The horizontal type of jaw growth makes the treatment of deep and mesial occlusion complicated yet is viewed as favorable in case of treating distal occlusion [2, 6, 8, 10, 16, 20, 22, 29, 33, 35, 38, 41].

The available scientific literature offered us no account of the most common types of growth for the jaw bones, nor for the facial part, in people with physiological occlusion. Noteworthy is the opinion of specialists claiming that the varieties of gnathic, dental face, an of the dental arches, which are to be found at physiological occlusion, manifest a wide range of shapes and sizes, as well as in the anterior teeth position, at protrusion or retraction [13, 15, 19, 24, 36, 39, 42].

All the above has laid the grounds for the aim of this study.

Aim of study

Identifying the features of the types of facial part growth according based on lateral projection teleroentgenogram data obtained from people with physiological occlusion.

MATERIALS AND METHODS

Teleradiographic study was performed in 292 people belonging to the age group of the first adulthood period (21–35), with physiological occlusion of the permanent teeth. The main indicator of the growth type for the gnathic face part was the lower jaw angle as measured between the tangent lines to the branch and the body of the lower jaw. One sign was not sufficient to determine the growth type, due to which we evaluated the total Bjork angle, the percentage ratio of the face back and front heights, the angle shaped by the skull base plane and the mandibular plane, as well as other parameters. To study the lateral teleroentgenogram, we employed the major points used for determining the growth type — ***N*** (***nasion***), ***S*** (***sella***), ***Ar*** (***articulare***), ***Ba*** (***basion***), ***Go*** (***gonion***), ***Me*** (***menton***), ***Gn*** (***gnation***), ***A*** (***subspinal point***), ***B*** (***supramental point***), ***Pt*** (***pterigoidea***), ***C*** (***condylen***), and others (Fig. 1).

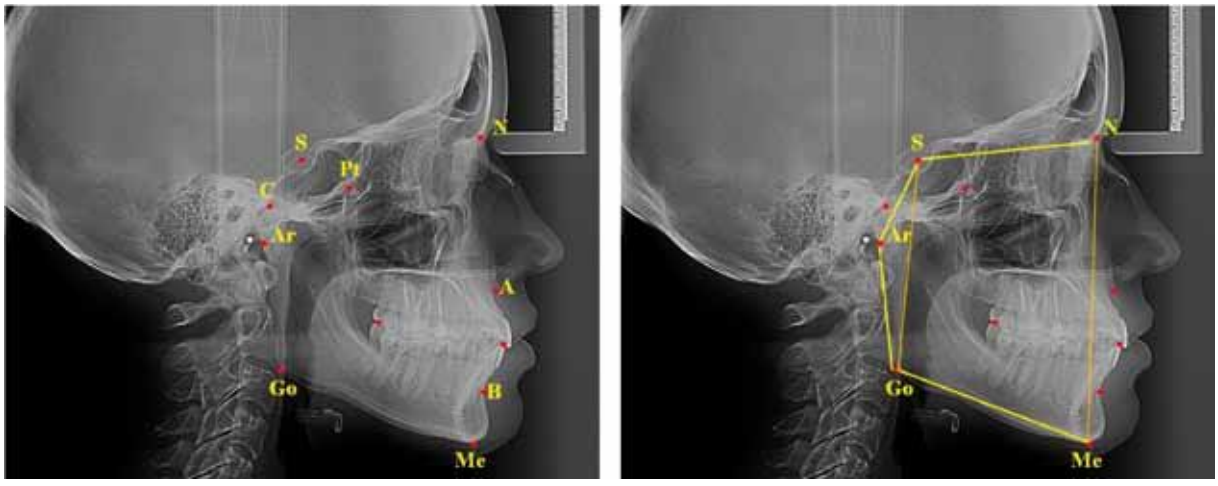

Fig. 1. *Teleroentgenogram of a patient with the location of the major points (a) and parameters (b) for identifying the jaw growth type*

The indicated points were connected with lines with the angles between them determined, or the percentage ratio of the linear parameters. The calculation for the total Bjork angle included three angles. First — the angle shaped by the N–S and S–Ar lines; second — the one created by the S-Ar and Ar–Go lines; third — the one that the Ar–Go and Go–Me lines shaped. The front face height was measured from the N (nasion) point to the Me (menton) point. The measurement for the rear height was done from the middle of the Turkish saddle (S, sella) to the lower jaw angle at the point (gonion) Go. The angle at by the skull base plane (N–S) and the mandibular plane (Me–Gn) was calculated as well. In addition, we determined the angle between the occlusal and mandibular planes, where the occlusal line was drawn from the incisor point to the distal cusp of the second lower molar. The Ricketts face angle was measured based on the location of the Pt-Me line regarding the Ba–N line.

Following the aims of the study, the patients were divided into three groups. Group 1 included patients whose indicators mostly corresponded to the neutral growth type of the facial part of the head. Change in the indices was indicative of either the horizontal or the vertical type of the facial part growth. Literature states that the neutral type of growth has the total Bjork angle of 393–399°, the angle of the lower jaw varies from 119 to 123°, the percentage of the face rear height to the front height (S–Go × 100 / N–Me) is to be found within 62–65%. Concerning the angle shaped by the skull base plane (N–S) and the mandibular plane (angle NL–ML), a value of 29–35° indicates the neutral type of growth. The lower gonial angle (N–Go–Me) at the neutral growth type is 69–77°, whereas the Ricketts face angle varies between 89–92°. Besides, we considered the angles determining the jaws position in relation to the skull (ANS and BNS). The position of the articular head was identified vertically (S–D) and horizontally (C–D), where the D point was the intersection of a perpendicular line to the skull base plane at the S point, and a perpendicular line drawn to it from the C point.

The teleradiographic data was recorded in Microsoft Excel spreadsheets. The results were computer-processed employing standard software packages with the variation statistics method and calculating the arithmetic mean as well as identifying the non-sampling error.

RESULTS AND DISCUSSION

The most objective indicator for the facial part growth type is the lower jaw angle shaped by the tangent lines to the jaw's body and branch. Its size, as a rule, affects the total Bjork angle, the front height of the face, the angles created by the mandibular plane and other planes of the head — the skull base plane, the spinal plane, the occlusal plane. The mandibular angle determines the parameters of the lower gonial angle (N–Go–Me) and the Ricketts face angle. Fig. 2 offers a view on various teleroentgenograms with different values of the mandibular angle.

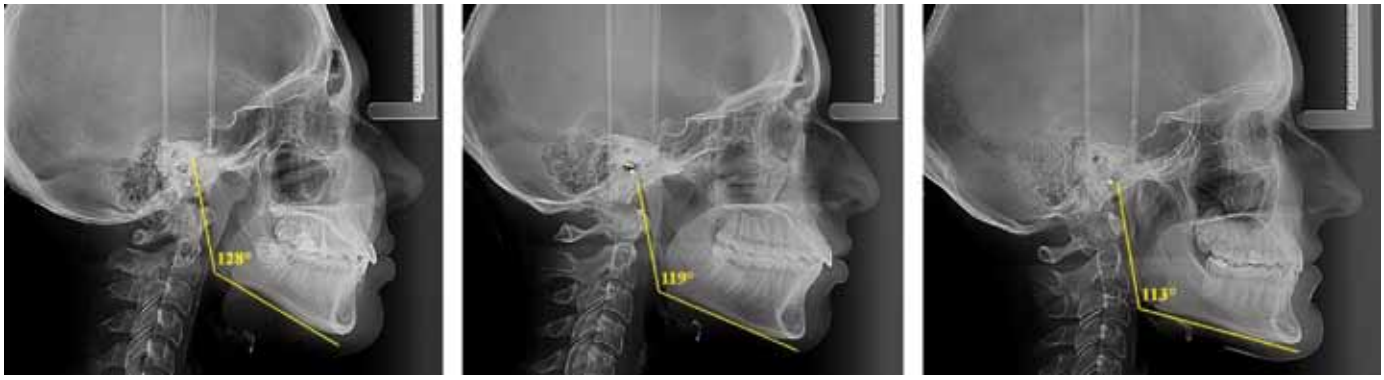

Fig. 2. *Teleroentgenograms of patients with the vertical (a), the neutral (b) and the horizontal (c) type of jaw growth*

Of the total number of the participants with physiological occlusion, 181 persons (61.99 ± 2.84%) had most of their growth-type indicators corresponding the neutral values. 89 persons were identified (30.48 ± 2.69% of the total body of participants) as having parameters pointing at the horizontal growth type. The smallest number of patients were those with the vertical type of growth (22 persons — 7.53 ± 1.55% of the total number). During that, the trend of the vertical growth was insignificant.

The measurements for the angular parameters of the lateral projection teleradiography can be seen from Table 1.

The study showed that, regardless of the growth type of the facial part of the head, the position of the jaws in relation to the main anatomical references corresponded to the physiological norm. There were no significant differences identified between the groups in terms of the ANS angle, which determines the location of the maxilla in the skull facial part. People with physiological occlusion have it varying from 85° to 88°. The parameters of the BNS angle are somewhat smaller, yet, they, too, proved not to depend on the growth type of the facial part of the head. The variability of the ANB angle was within 2–3°. A slight increase in the angle is typical of people with the vertical growth type, while a decrease was observed in case of the horizontal growth type of the head facial part. Notable is the inconsistency of the total Bjork angle as it is determined here. For all types of growth, it was below the values that are to be found in the respective literature. Nevertheless, there were significant differences identified concerning the parameters of the groups under examination. In people with the neutral growth type, the angle varied from 380° to 384°. A smaller angle was typical for the horizontal growth, whereas an increase for the vertical type. The differences in the mandibular angle had their effect on the lower gonial angle (NGoMe) parameters. For the neutral growth type, its value ranged from 69° to 74° and corresponded to the values obtained through the study. Also, significant differences were revealed based on the angle between the skull base plane and the mandibular line. For the neutral growth type, the value of the parameter was 29.39 ± 1.75°. In people with the neutral type of growth the Ricketts face angle is approaching the right angle. As far as the horizontal type of growth is concerned, the angle is obtuse; in case of the vertical type of growth — sharp. It is interesting to look at the angle shaped by the occlusal and mandibular planes. For the neutral type of growth, its value varied from 14° to 16°. The systematization of the data allowed establishing the teleroentgenograms basic angular parameters, which are typical of persons with different growth types of the facial part of the head.

Table 1. *Major angular teleroentgenogram parameters for people with different facial part growth, (°), (M±m), (p≤0,05)*

Angular teleroentgenogram parameters	Type of facial part growth		
	neutral	horizontal	vertical
Bjork angle	382.06±2.06	375.33±1.27	388.53±1.67
N-Go-Me angle	71.61±1.98	64.33±1.26	79.15±1.82
Mandibular angle	120.07±1.24	113.22±0.84	127.65±1.68
NL – ML angle	29.39±1.75	19.78±1.92	36.48±2.87
OL – ML angle	15.04±0.48	9.02±0.88	17.52±0.51
Ricketts angle	90.44±1.14	98.89±1.39	86.68±1.38
ANS angle	87.11±1.21	87.33±1.15	86.52±1.34
BNS angle	84.17±1.35	85.67±1.46	82.38±1.96
ANB angle	2.94±0.81	1.67±0.96	4.12±1.83

In addition, we evaluated the linear parameters of the teleradiography, in particular, the height of the anterior and posterior parts of the face, as well as we evaluated their ratio. Also, we evaluated the location of the mandible articular head with respect to the position of the Turkish saddle, both vertically and horizontally.

Table 2 offers the measurements for the teleroentgenograms linear parameters, lateral projection.

Table 2. *Major linear parameters of teleroentgenograms for people with various facial growth types, (mm), (M±m), (p≤0.05)*

Teleradiographic linear parameters	Growth types of facial part of head		
	neutral	horizontal	vertical
N-Me (front height)	115.04±1.64	107.73±1.76	118.49±1.72
S-Go (rear height)	76.06±1.39	82.09±1.63	72.51±1.44
S-D (vertical)	19.27±1.35	20.09±1.29	17.47±1.54
C-D (sagittal)	14.17±1.21	12.61±1.18	11.79±1.23

The front height of the face in people with the horizontal type of growth was significantly below than that in the vertical type. At the same time, the height of the rear face area in people with the horizontal type of growth exceeded that in people with the vertical type of the face growth. In this regard, the percentage ratio of these parameters changed. The value of the S–Go × 100 / N–Me ratio was: for the neutral growth type of the facial part of the head — 71.61 ± 0.98%; for the horizontal type — 76.24 ± 1.64%; for the vertical type — 61.18 ± 1.64%. The groups of participants manifested no statistically reliable differences in the articular heads location in relation to the skull base and, in particular, related to the Turkish saddle.

CONCLUSIONS

1. The teleroentgenogram head measurements in the lateral projection are objective and informative when studying the size and location of the face skull bones, as well as the main growth directions of the head facial part.
2. The growth types of the facial part of the head are determined by the teleroentgenogram basic linear and angular parameters, as well as by the main types of the jaw growth.
3. With the physiological occlusion, there have been three main types identified for the growth of the head facial part; their distribution, however, is uneven. The highest number of people with physiological occlusion manifested the teleradiographic values pertaining to the neutral type of growth (181 people – 61.99 ± 2.84% of the total number). 89 participants were identified to have indicators pointing at the horizontal type of growth (30.48 ± 2.69%). The lowest number of the participants belonged to the group with the vertical growth type (22 persons — 7.53±1.55%).
4. The study has revealed no stable tendency detected towards the vertical growth of the facial part of the head.

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