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CEPHALOMETRIC PARAMETERS OF BASAL CRANIAL STRUCTURES ACCORDING TO METHOD "CEPHALOMETRICS FOR ORTHOGNATHIC SURGERY" IN UKRAINIAN YOUNG MEN AND YOUNG WOMEN WITH ORTHOGNATHIC OCCLUSION DEPENDING ON THE TYPE OF FACE

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The study established the limits of the cephalometric parameters percentile range of basal cranial structures, determined by the method of "Cephalometry for orthognathic surgery" (COGS-method), in Ukrainian boys and girls with orthognathic occlusion depending on the facial type. In almost all cases, boys with different facial types have significantly greater Ar-Pt and Pt-N distances or tend to have greater values than girls with corresponding facial types (very wide, wide, medium and narrow). There are almost no reliable or tendency differences between cephalometric indices between boys or girls with different face types.

Key words: teleradiography, cephalometry, COGS-method, boys, girls, orthognathic occlusion, face types.

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ЦЕФАЛОМЕТРИЧНІ ПАРАМЕТРИ БАЗАЛЬНИХ КРАНІАЛЬНИХ СТРУКТУР ЗА МЕТОДОМ «ЦЕФАЛОМЕТРІЯ ДЛЯ ОРТОГНАТИЧНОЇ ХІРУРГІЇ» В УКРАЇНСЬКИХ ЮНАКІВ І ДІВЧАТ ІЗ ОРТОГНАТИЧНИМ ПРИКУСОМ У ЗАЛЕЖНОСТІ ВІД ТИПУ ОБЛИЧЧЯ

У ході дослідження встановлені межі процентильного розмаху цефалометричних параметрів базальних краніальних структур, що визначаються за методом «Цефалометрія для ортогнатичної хірургії» (COGS-метод), в українських юнаків і дівчат із ортогнатичним прикусом у залежності від типу обличчя. Практично в усіх випадках в юнаків із різними типами обличчя величина відстаней Ar-Pt і Pt-N достовірно більша або має тенденцію до більших значень, ніж у дівчат із відповідними типами обличчя (дуже широким, широким, середнім і вузьким). Між юнаками або дівчатами з різними типами обличчя практично не встановлено достовірних, або тенденцій відмінностей даних цефалометричних показників.

Ключові слова: телерентгенографія, цефалометрія, COGS-метод, юнаки, дівчата, ортогнатичний прикус, типи обличчя.

The study is a part of the research project "Current trends and latest technologies in the diagnosis and treatment of odontopathology, diseases of periodontal tissues and oral mucosa", state registration No. 0118U005471.

Among the sections of dentistry, such sections as orthodontics and maxillofacial surgery occupy a special place. Common to them and at the same time unique among other branches of dentistry is the specialization in the elimination of facial defects both directly and indirectly.

Underestimating the role of the dentition in shaping a person's harmonious face is one of the biggest mistakes a patient can face. Technological and scientific advances have combined knowledge in the fields of anthropology, radiology, orthodontics and maxillofacial surgery created a method of cephalometric analysis [7]. This method includes from a theoretical point of view an understanding of the relationship between tooth-jaw and cranial structures, and from a practical point of view – the use of X-ray examination and subsequent processing of the images.

The result is development of a powerful tool for predicting and planning dental intervention in the maxillofacial system, which makes it possible not only to form the right smile, but also to change the characteristics of the face, allowing it to harmonize.

The importance and necessity of routine use of this method is still under discussion. A.R. Durão and co-authors [7] claim that orthodontists with more experience most often follow the treatment plan according to cephalometric analysis (67 %), while inexperienced people deviate much more from the treatment plan according to this method (28 %). At the same time, the effectiveness of the analysis was a total of 64 %, and the most frequent changes in the use of treatment methods were observed in patients with class II occlusion.

At the same time, other studies suggest that cephalometric studies have a significant evidence base, but should not be routinely used in orthodontic practice, and a clear algorithm must be followed to understand whether or not it is necessary [10]; single publications [5] indicate that the importance of cephalometric analysis is insignificant and its use does not significantly affect treatment outcomes.

One of the problems that hinders the full use of cephalometric analysis in the practice of orthodontists and maxillofacial surgeons is the significant impact on the normative indicators of various

variables, such as sex, ethnicity, age, face type [8, 11] and so on. In addition, it is necessary to take into account a large number of methods of cephalometric analysis that currently exist and have become widespread in practice. All this encourages local communities of scientists to adapt normative indicators for certain methods of cephalometric analysis according to the local population, taking into account as many variables as possible.

The purpose of the study was to establish the limits of the percentile range and features of cephalometric parameters of basal cranial structures, determined according to method "Cephelometrics for orthognathic surgery" (COGS-method) in Ukrainian young men and young women with orthognathic occlusion depending on the type of face.

Materials and methods. A cephalometric study (using a dental cone tomograph Veraviewepocs 3D Morita) of 46 young men (YM) (aged 17 to 21 years) and 72 young women (YW) (aged 16 to 20 years) taken from the database of the Research Center and the Department of Pediatric Dentistry of National Pirogov Memorial Medical University, Vinnytsya. The main conditions for the selection of candidates for the study were belonging in three generations to the inhabitants of Ukraine of Caucasian race, and the presence of physiological occlusion, which was as close as possible to orthognathic (hereinafter – orthognathic occlusion). Committee on Bioethics of National Pirogov Memorial Medical University, Vinnytsya (protocol No. 8 from 30.09.2021) found that the studies do not contradict the basic bioethical standards of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant WHO regulations and laws of Ukraine.

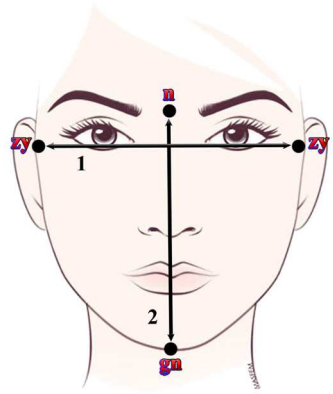

Fig. 1. Location of the main cephalometric points and indicators of the greatest width and morphological length of the face. 1 – The largest width of the face (zy-zy); 2 – Morphological length of the face (n-gn).

Determination of the type of person's face according to which the actual division into groups took place was carried out according to the values of Garson's morphological index [2] (fig. 1). The calculation was performed according to the formula: Garson index=(morphological length of the face/maximum width of the face)×100.

The distribution of persons according to the value of the Garson index was: YM – 5 with a very wide face, 22 with a wide face, 11 with a medium face, 8 with a narrow face; YW – 25 with a very wide face, 25 with a wide face, 10 with a medium face, 12 with a narrow face.

In our study, we chose a modern specialized for orthognathic surgery COGS-method, (abbreviation comes from the English word combination – "Cephelometrics for orthognathic surgery"), which was described by Burstone C.J. and others [4].

For the convenience of perception, correct modelling and convenient further clinical use and structuring of a large array of metric characteristics, we used the distribution of teleradiographic indicators proposed by Dmitriev M.O. [1], according to which the first group includes metric characteristics of the skull, which usually do not change during surgery and orthodontic treatment.

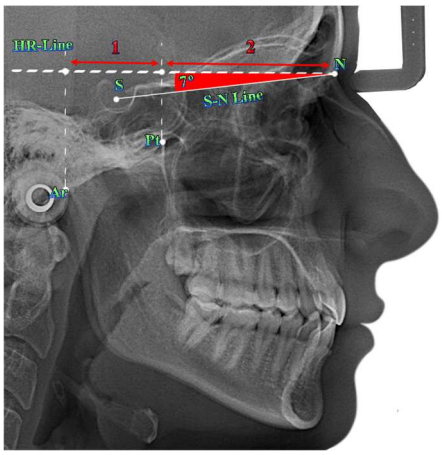

Fig. 2. The main cephalometric points and measurements included in the first group of indicators according to COGS-method. 1 – distance Ar-Pt; 2 – distance Pt-N.

The main cephalometric points and measurements included in the first group of indicators (Fig. 2): Ar-Pt distance – (posterior section of cranial base, length of the posterior part of the skull base) – the distance from the Ar point to the Pt point defined along the HR-Line (HR-Line – line drawn through the point N and seven degrees above the S-N line) (mm); distance Pt-N – (anterior section of cranial base, the length of the anterior part of the skull base) – the distance from the point Pt to the point N determined along the Hr-Line (mm); Ar (articulare) – the intersection of the anterior surface of the main part of the occipital bone with the posterior surface of the neck of the mandible; N (nasion) – the most anterior point of the fronto-nasal suture, the connection of the frontal and nasal bones in the middle-sagittal plane; Pt (pterygomaxillare) – the upper distal point of the pterygomaxillary fissure, located at the intersection of the round hole with the posterior wall of the pterygomaxillary fissure; S (sella) is a constructive point in the center sella turcica.

Statistical processing of the obtained results was performed in the license package "Statistica 6.0" using non-parametric evaluation methods. Mean for each trait, standard deviation, and percentile range were determined. The reliability of the difference between the values between the independent quantitative values was determined using the U-Mann-Whitney test.

Results of the study and their discussion. As a result of the conducted researches in YM and YW with orthognathic occlusion with different types of faces the limits of percentile scope of the size of distances Ar-Pt and Pt-N are established:

– the value of the distance Ar-Pt – in YM and YW with a very wide face type, respectively, 33.6–34.6 mm and 27.6–32.0 mm; in YM and YW with a wide face type, respectively 31.5–35.7 mm and 28.8–32.9 mm; in YM and YW with an average face type of 30.0–36.1 mm and 30.2–33.2 mm, respectively; in YM and YW with a narrow face type, respectively 31.7–36.3 mm and 28.2–33.2 mm;

– the value of the distance Pt-N – in YM and YW with a very wide face type, respectively, 54.4-55.8 mm and 47.8–52.1 mm; in YM and YW with a wide face type 52.4–55.3 mm and 47.0–52.5 mm respectively; in YM and YW with an average face type of 50.0–54.9 mm and 48.9–50.1 mm, respectively; in YM and YW with narrow face type 51.5–55.8 mm and 46.3–51.0 mm respectively.

When comparing the Ar-Pt distance in YM with very wide (34.06±1.45 mm) and wide (33.40±2.51 mm) facial types, significantly ($p<0.01$ in both cases) higher values were found compared to YW of the corresponding facial type (29.80±2.97 mm and 30.81±2.56 mm). In addition, the value of Ar-Pt distance in YM narrow face type (33.65±3.73 mm) has a pronounced tendency to higher values ($p=0.054$) than in YW with narrow face type (30.57±3.38 mm) (fig. 3).

When comparing the value of the distance Pt-N in YM with very wide (54.74±1.96 mm), wide (53.04±2.87 mm), medium (52.54±2.59 mm) and narrow (53.98±3.09 mm) face types are established reliably ($p<0.05$-0.001) larger values compared to YW of the corresponding face type (respectively 50.46±3.11 mm – 49.58±2.94 mm – 49.98±2.62 mm – 49.27±3.12 mm) (fig. 4).

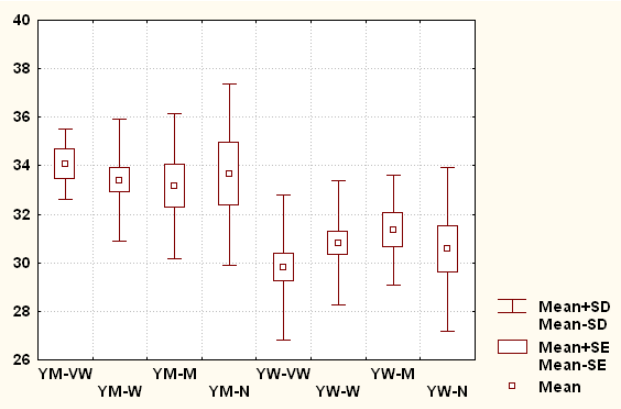

Fig. 3. The value of the distance Ar-Pt in young men and young women with different face types (mm). Notes: here and in the following figures, YM- – young men; YW- – young women; -VW – very wide type of face; -W – wide face type; -M – medium face type; -N – narrow face type; Mean – the average of the sample; ±SE – error of the average; ±SD – standard deviation.

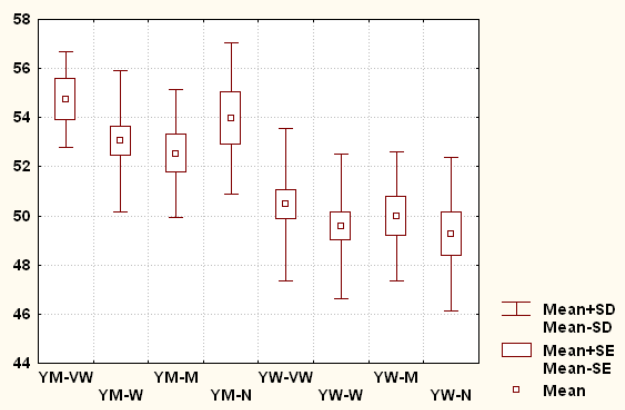

Fig. 4. The magnitude of the Pt-N distance in young men and young women with different face types.

When comparing the Ar-Pt or Pt-N distances between YM or YW with different face types, only the tendency to higher values ($p=0.068$) of the Ar-Pt distance value in YW with the average face type was found (31.35±2.27 mm) than in YW with a very wide face type (29.80±2.97 mm).

Thus, as a result of our research, the limits of percentile scale and pronounced manifestations of sexual dimorphism (higher values in YM with different face types) metric characteristics of the skull according to COGS-method, which usually do not change during surgical and orthodontic treatment. There are almost no significant or trends in the differences of these cephalometric indicators between YM or YW with different facial types. It should be noted that Drachevska I.Yu. etc. [6] in Ukrainian YM and YW with orthognathic occlusion and different facial types also found pronounced sex differences in basal cranial structures used in the methods of Schwartz, Jarabak, Ricketts and Bjork, and found no significant or trends in differences between these indicators between representatives with different face types.

COGS-analysis, also known as cephalometrics for orthognathic surgery, was co-authored by Burstone in 1978 and describes the horizontal and vertical arrangement of facial bones; various indicators in this method are measured according to the true horizontal plane [3].

However, like most other methods of cephalometric analysis, a typical problem is the need to adapt regulations to the local population. The results of numerous studies in different parts of the world strongly confirm the existence of at least ethnic differences.

Thus, a teleradiographic study using the COGS-method of 106 people, ethnic Sudanese, aged 18–25 years revealed differences compared with the normative indicators. Sudanese, unlike Europeans, have a more convex facial profile, a blunt lower throat, greater protrusion of the upper and lower lips. Men have higher prognathism of the upper and lower jaws and a blunt lower corner of the face compared to women [9].

A similar study was performed to adapt the method for the population of East India. Examination of 100 men and 100 women aged 18–30 years without abnormalities of the face and dental system, as well as a harmonious face revealed the following features: compared to Europeans, East Indians have higher rates of protrusion of the upper lip and lower lip and prognathism of the lower jaws according to the COGS-method [13].

In another experiment, a group of scientists also found differences in a survey of people in northern India [15].

Positive results were also obtained from the analysis of a survey of 500 residents of Saudi Arabia. As in the works described above, the classical criteria for selection of study participants were used and the analysis of teleradiograms by the COGS-method was performed. In particular, the authors found differences in performance between men and women – the former had a more convex profile of the face and protrusion of the chin [14].

G. Averistus and others [3] analyzed 470 teleradiograms of Malays and Malaysian Chinese aged 18–25 years using COGS-analysis. The identified cephalometric landmarks were measured and subject to further statistical processing. Of the 38 indicators studied, 16 had statistically significant differences between the representatives of the studied nationalities ($p<0.05$). In addition, the manifestations of sexual dimorphism were inserted (4 indicators were statistically significantly different in Chinese and 18 in Malays).

There are also more and more studies where scientists point out the importance of studying the relationship between facial type and its effect on cephalometric parameters [8, 12].

Thus, the results of our study are consistent with data obtained in other countries and confirm the generally accepted global trend, namely – the need to adapt regulations to different methods of cephalometric analysis taking into account ethnicity, age, sex and even facial type. The work allowed to bring the full implementation of the COGS-method in practical application by Ukrainian orthodontists and maxillofacial surgeons.

Conclusions

1. In Ukrainian YM and YW with orthognathic occlusion with very wide, wide, medium and narrow facial types, the limits of the percentile range of cephalometric parameters of basal cranial structures, determined according to the COGS-method, are established.

2. The expressed sexual differences (bigger values in YM with different types of the person) of size of distances Ar-Pt and Pt-N (more expressed) are established.

3. There are practically no significant or trend differences in cephalometric parameters of basal cranial structures, determined by the COGS-method between YM or YW with different face types.

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COMPREHENSIVE REHABILITATION OF CHILDREN WITH SENSORY AND INTELLECTUAL DISORDERS

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The article presents the results of comprehensive rehabilitation of primary school children with sensory and intellectual disabilities, namely children with sensorineural deafness combined with mild mental retardation. The purpose of the study was to test the effectiveness of a comprehensive, differentiated system of correctional and health work with children of primary school age with complex developmental disorders. This study lasted during 2013–2021, during which a comprehensive rehabilitation of 100 children of primary school age (7–10 years) with severe developmental disabilities, including 53 girls and 47 boys, was carried out. It was found that after a comprehensive corrective and health work in girls of the experimental group of 7–10 years, the repeated indices of the vital index were probably better compared to CG girls of 7–10 years by 4.87 %, strength index – by 3.24 %, Stange's test – by 3.78 seconds, Genchi's test – by 4.69 seconds, Ruffier's test – by 3.26 c.u., Skibinski's index – by 2.32 c.u. At the same time, there was a positive trend in EG boys aged 7–10 years, where recurrent vital signs were probably better than in CG boys aged 7–10 years by 3.00 %, strength index – by 3.97 %, Stange's test – by 6.98 seconds, Genchi's test – by 2.02 seconds, Ruffier's test – by 3.14 c.u., Skibinski's index – by 2.33 c.u. The study's results confirmed their practical significance in the implementation of medical, psychological and pedagogical rehabilitation of this category of children.

Key words: rehabilitation, physical development, hearing disorders, intellectual disorders, children with complex developmental disorders, correctional and health-improving work.

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КОМПЛЕКСНА РЕАБІЛІТАЦІЯ ДІТЕЙ ІЗ СЕНСОРНИМИ ТА ІНТЕЛЕКТУАЛЬНИМИ ПОРУШЕННЯМИ

У статті представлені результати комплексної реабілітації дітей молодшого шкільного віку із сенсорними та інтелектуальними порушеннями, а саме дітей із нейросенсорною глухотою у поєднанні з легкою розумовою відсталістю. Метою дослідження була перевірка ефективності комплексної, диференційованої системи організації корекційно-оздоровчої роботи з дітьми молодшого шкільного віку зі складними порушеннями розвитку. Дане дослідження тривало протягом 2013–2021 рр., в ході якого проведено комплексну реабілітацію 100 дітей молодшого шкільного віку (7–10 років) зі складними порушеннями розвитку, з них 53 дівчат та 47 хлопців. В результаті дослідження було встановлено, що після проведення комплексної корекційно-оздоровчої роботи у дівчат експериментальної групи 7–10 років повторні показники життєвого індексу були вірогідно кращі порівняно з дівчатами КГ 7–10 років на 4,87 %, силового індексу – на 3,24 %, проби Штанге – на 3,78 с, Генчі – на 4,69 с, індексу Руф'є – на 3,26 у.о., індексу Скібінського – на 2,32 у.о. Поряд з цим відмічена позитивна динаміка у хлопчиків ЕГ 7–10 років, де повторні показники життєвого індексу були вірогідно кращі порівняно з хлопчиками КГ 7–10 років на 3,00 %, силового індексу – на 3,97 %, проби Штанге – на 6,98 с, Генчі – 2,02 с, індексу Руф'є – на 3,14 у.о., індексу Скібінського – на 2,33 у.о. Отримані результати дослідження підтвердили їх практичне значення у здійсненні медичної і психолого-педагогічної реабілітації означеної категорії дітей.

Ключові слова: реабілітація, фізичний розвиток, порушення слуху і мовлення, інтелектуальні порушення, діти зі складними порушеннями розвитку, корекційно-оздоровча робота.

The work is a fragment of the research project "Psychological and pedagogical support of correctional and rehabilitation work with children with special educational needs", state registration No. 0119U002024.

The development of the state in the context of European guidelines implies a focus on the health of the younger generation. An essential role in improving the population's health status is played by the individual's awareness of the need to preserve their health and maintain a healthy lifestyle, which is greatly facilitated by the effective organization of correctional and health-improving work. However, to help