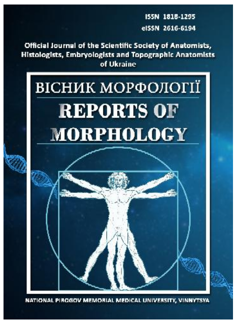
DOI: 10.31393/morphology-journal-2024-30(2)-10 Reports of Morphology, Vol. 30, №2, Pages 76-83

ISSN 1818-1295 eISSN 2616-6194

REPORTS OF MORPHOLOGY

Official Journal of the Scientific Society of Anatomists, Histologists, Embryologists and Topographic Anatomists of Ukraine

journal homepage: https://morphology-journal.com



Modeling of individual teleroentgenometric indicators using the "Cephalometrics for orthognathic surgery" method in Ukrainian young women with a wide face type and orthognathic bite

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ARTICLE INFO
Received: 07 February 2024
Accepted: 11 April 2024

UDC: 616.714.1-071.3(477)

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CONFLICT OF INTEREST
The authors have no conflicts of interest to declare.

FUNDING
Not applicable.

DATA SHARING
Data are available upon reasonable request to corresponding author.

The study of individual normative cephalometric parameters in individuals of different sexes and ages is important for the "Cephalometrics for orthognathic surgery method", as it allows to accurately diagnose abnormalities and develop personalized treatment plans. This contributes to achieving better aesthetic results, reducing the risk of complications and increasing the effectiveness of surgical interventions. Taking into account age, sex, and face type helps predict long-term changes and adapt the treatment plan to obtain optimal results. In addition, it improves assessment accuracy and standardizes evidence-based approaches, making it easier to compare results between clinics. Thus, individual regulatory parameters are key to successful orthognathic surgery. The purpose of the study is to build and analyze regression models of teleroentgenometric indicators using the "Cephalometrics for orthognathic surgery" method in Ukrainian young women with a wide face type. 25 Ukrainian young women with an orthognathic bite and a wide face type underwent a cephalometric study using the "Cephalometrics for orthognathic surgery" (COGS-method) method. For the correct modeling of cephalometric parameters, their division into three groups was applied (Dmitriev M. O., 2016, 2017): the first group - basic metric characteristics of the skull; the second group - teleroentgenometric indicators by which it is possible to change the parameters of the upper and lower jaws with the help of orthognathic surgery; the third group - indicators that characterize the position of each tooth relative to each other, cranial structures and the profile of the soft tissues of the face. Construction of regression models was carried out in the license package "Statistica 6.0". Only reliable models with a coefficient of determination R^2 of at least 0.60 were subject to further analysis. It was found that in young women with a wide face, using the COGS method, 6 models of teleroentgenometric indicators were built out of 33 possible, which were included in the second and third groups depending on the indicators of the first group (R^2= from 0.601 to 0.705, p<0.01-0.001); out of 19 possible, 16 indicator models were built, which were included in the third group depending on the indicators of the first and second groups (R^2= from 0.614 to 0.983, p<0.01-0.001). The analysis of the models showed that most often the regression equations of the indicators included in the second and third groups, depending on the indicators of the first group, include the distance P-PTV and N-CC according to Ricketts, N-Se according to Schwarz, N-S and S-Ar according to Roth-Jarabak, Ar-Pt and Pt-N according to the COGS method (7.69 % each), as well as the value of the H angles according to Schwarz and N-S-Ba according to Bjork; and to the indicator models that were included in the third group depending on the indicators of the first and second groups - the value of the distances ANS-Me, N-B, N-A, N-Pog, B-Pog, N-CC according to Ricketts, PNS-N, Ar-Go and ANS-PNS, as well as the magnitude of the angles N-A-Pog, N-S-Ba according to Bjork, MP-HP, as well as Por-NBa according to Ricketts.

Keywords: *regression analysis, teleroentgenography, cephalometry according to the method "Cephalometrics for orthognathic surgery", young women, facial types, orthognathic bite.*

Introduction

Pathology of the dental and jaw system has become widespread. Thus, fractures of the maxillofacial area requiring further orthodontic treatment are not uncommon. In a study by Daneste H. and Bayat P. [7], it was found that 65% of patients with fractures of the maxillofacial area were men, 35 % were women, and the average age was 38.5 years. Lefort I fracture was found in 25 % of patients, Lefort II in 31 %, and Lefort III in 11 %. The causes of fracture of the upper jaw in 46% were car accidents, in 26 % violence, and in 27 % accidents at work and during sports. On the example of one hospital in Togo, it was found that the occurrence rate of Lefort fractures was 15.2 cases. As in the previous study, the main group consisted of individuals of working age of 34.43±11.98 years. Lefort II fracture occurred in 51.06 % of cases. Treatment was surgical in 99.34 % [12].

The prevalence of backbite in the world is about 1.0 % to 1.5 % according to various estimates. The prevalence of Brodie's bite is from 0.5 to 2.3 %. The prevalence of scissor bite is from 0.5 to 5.9 % [18]. Data from the examination of children in one of the regions of Saudi Arabia showed that more than half of the examinees had Class I malocclusion (anterior crossbite, posterior crossbite, open bite, etc.). More than 20% of the participants needed orthodontic treatment [2].

The significant prevalence of various types of orthodontic pathology can be explained by the fact that bad oral habits (thumb sucking, use of a pacifier) greatly contribute to the emergence of pathological types of bite, such as posterior crossbite [13].

Such a number and spread of orthodontic pathology led to the search for tools and techniques to facilitate planning and predicting the results of orthodontic intervention.

Lateral cephalometry, which was proposed in 1931 by Broadbent, is used to characterize facial morphology, predict the growth of the facial skeleton, plan orthodontic treatment, and evaluate treatment outcomes. Cephalometric analyses, which have increased in number in recent decades, provide angular and linear measurements useful for diagnostic purposes and orthodontic treatment planning [11, 28]. At the same time, there are still ongoing discussions about whether it is necessary to conduct a routine cephalometric examination in every case of a patient seeking orthodontic care [16, 30].

Evaluation of economic efficiency is an equally important component in orthodontic practice [19]. M. Bengtsson and co-authors [5] planned the treatment of persons with severe class III malocclusion with 2- and 3-dimensional techniques, comparing costs with benefits. A study involving 57 people showed that the 2-dimensional technique had a large cost advantage and required a significantly lower radiation dose compared to the 3-dimensional technique. In addition, an active discussion is taking place regarding the comparison of the clinical effectiveness of 2-dimensional and 3-dimensional techniques of cephalometric research [28].

In 2015, Burstone C. J. passed away, who, in co-authorship with various researchers, in particular Legan H., in 1979 developed a new method of cephalometric analysis of lateral teleroentgenograms, known as Cephalometrics for orthognathic surgery or the Burstone Legan analysis, which became widely used throughout the world [25]. At the same time, like many other methods of analysis, its main drawback is its inapplicability to different ethnic groups. In addition, the accuracy decreases due to the failure to take into account other factors - sex, age, type of face, etc. Thus, the effective application of this method of analysis is possible only by carrying out research on the local population, taking into account these and other important factors.

The purpose of the study is to build and analyze regression models of teleroentgenometric indicators using the "Cephalometrics for orthognathic surgery" method in Ukrainian young women with a wide face type.

Materials and methods

25 young women (YW) with a wide facial type according to Garson [27] (aged 16 to 20 years), who belonged in three generations to residents of Ukraine of the Caucasian race and had a physiological bite as close as possible to the orthognathic one, underwent a cephalometric study using the "Cephalometrics" method for orthognathic surgery" (COGS method) [6]. The OnyxCeph³™ software, version 3DPro, from Image Instruments GmbH, Germany (software license #URSQ-1799) was used for the study. Primary teleradiograms, which were obtained using a

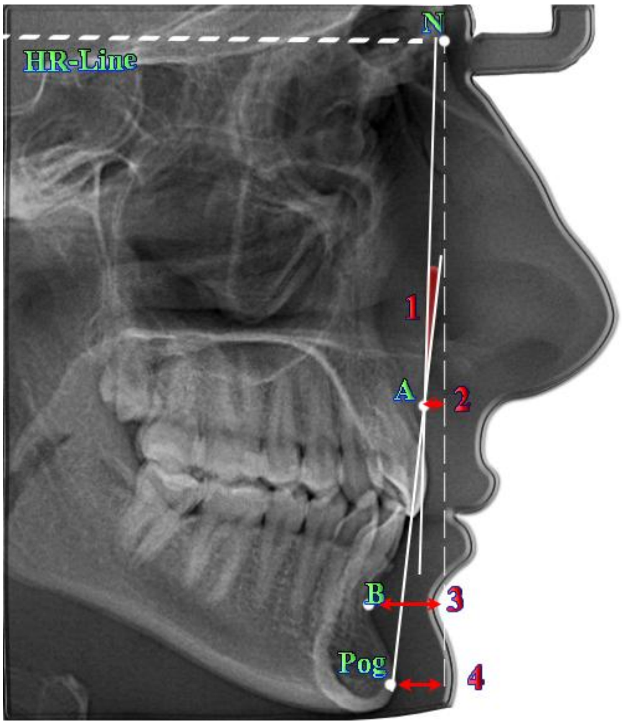

Fig. 1. The second group of teleroentgenometric indicators according to COGS-method: 1 - angle N-A-Pog (°); 2 - distance N-A (mm); 3 - distance N-B (mm); 4 - distance N-Pog (mm).

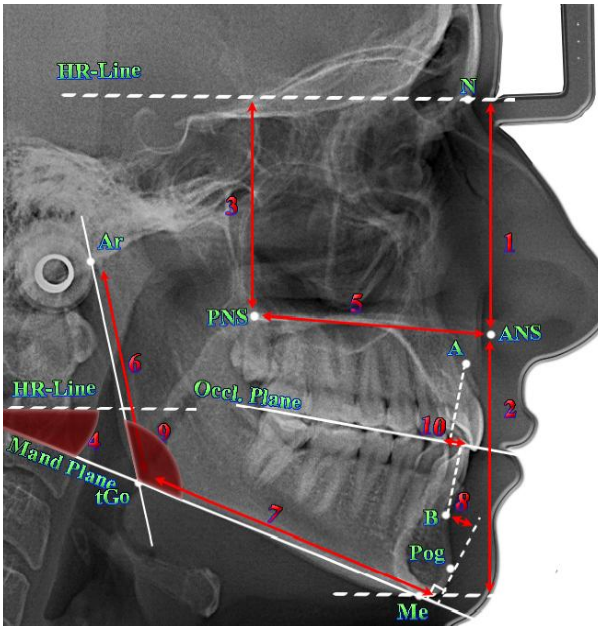

Fig. 2. The second group of teleroentgenometric indicators according to COGS-method: 1 - distance N-ANS (mm); 2 - distance ANS-Me (mm); 3 - distance PNS-N (mm); 4 - angle MP-HP (°); 5 - distance ANS-PNS (mm); 6 - distance Ar-Go (mm); 7 - distance Go-Pog (mm); 8 - distance B-Pog (mm); 9 - angle Ar-Go-Gn (°); 10 - distance A-B (mm).

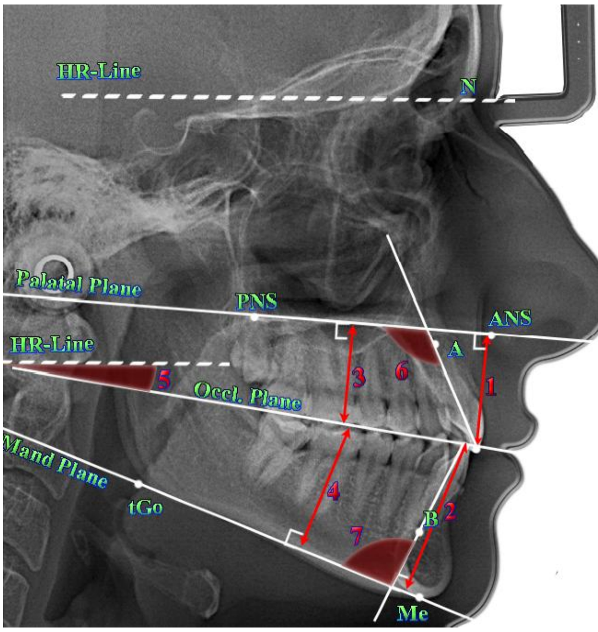

Fig. 3. The third group of teleroentgenometric indicators according to COGS-method: 1 - distance 1u-NF (mm); 2 - distance 1l-MP (mm); 3 - distance 6u-NF (mm); 4 - distance 6l-MP (mm); 5 - angle OP-HP (°); 6 - angle Max1-NF (°); 7 - angle Mand1-MP (°).

Veraviewepocs 3D Morita dental cone beam tomograph, taken from the database of the Research Center and the Department of Pediatric Dentistry of the National Pirogov Memorial Medical University, Vinnytsya (all YW applied to the private dental clinic "Vinintermed" for diagnostic examination and gave voluntary consent for the further use of the obtained results in our study).

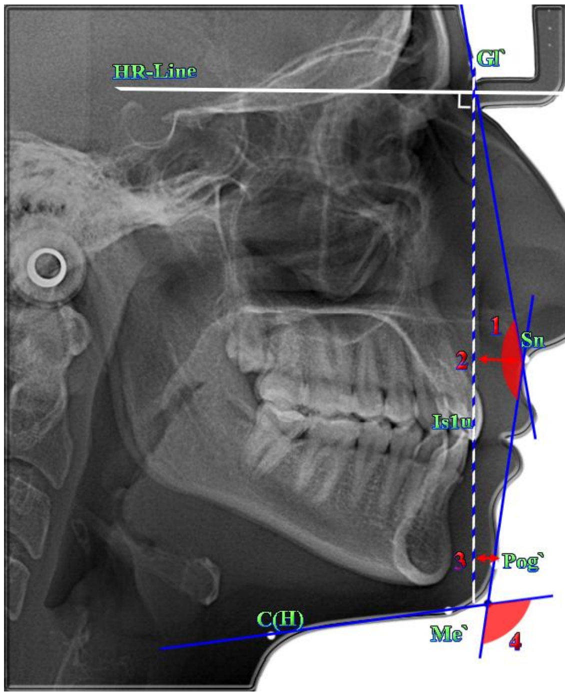

Fig. 4. The third group of teleroentgenometric indicators according to COGS-method, which characterize the shape of the facial profile: 1 - angle Gl'-Sn-Pog' (°); 2 - distance Gl'-Sn (mm); 3 - distance Gl'-Pog' (mm); 4 - angle Sn-Gn'-C (°).

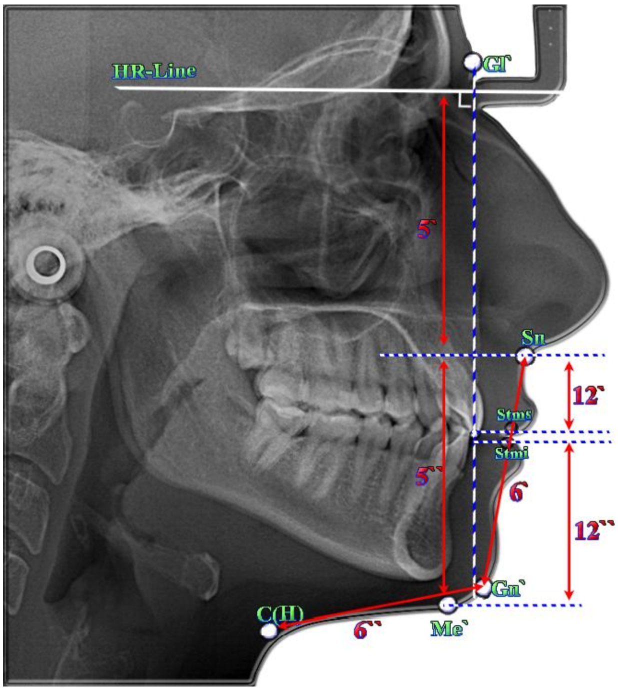

Fig. 5. The third group calculated teleroentgenometric indicators according to COGS-method, which characterize the *shape of the facial profile*: 5 - ratio Gl'-Sn(5')/Sn-Me'(5'') (%); 6 - ratio Sn-Gn'(6')/C-Gn'(6'') (%); and *the position and shape of the lips*: 12 - ratio Sn-Stms(12')/Stmi-Me'(12'') (%).

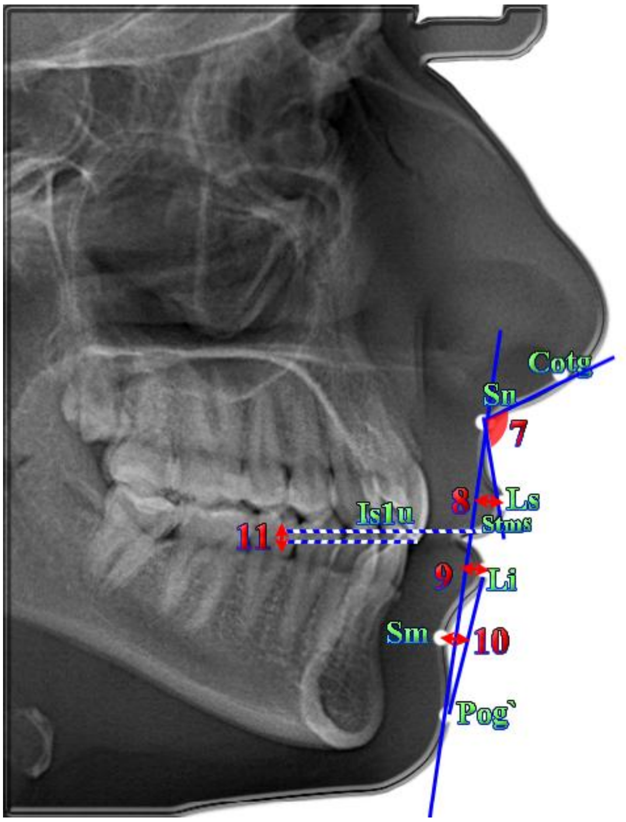

Fig. 6. The third group of teleroentgenometric indicators according to COGS-method, which characterize the position and shape of the lips: 7 - angle Cotg-Sn-Ls (°); 8 - distance Ls-(Sn-Pog') (mm); 9 - distance Li-(Sn-Pog') (mm); 10 - distance Sm-(Li-Pog') (mm); 11 - distance Stms-I (mm).

Committee on Bioethics of National Pirogov Memorial Medical University, Vinnytsya (protocol № 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.

For the correct modeling of teleroentgenometric indicators, we used their division into three groups proposed by Dmitriev M. O. [9, 10]:

the first group - basic cranial indicators, which usually do not change during surgical and orthodontic treatment. Because in the COGS methodology, only distances Ar-Pt (mm) and Pt-N (mm) belong to them, we also used the following most common cephalometric indicators of other authors: Schwarz N-Se distance (mm), Roth-Jarabak N-S distance (mm), Ricketts N-CC distance (mm), Steiner S-E distance (mm); S-Ar distance according to Roth-Jarabak (mm), P-PTV distance according to Ricketts (mm), S-Ar' distance according to Roth-Jarabak (mm), angle H according to Schwarz (°), POr-NBa angle according to Ricketts (°), angle N-S-Ba by Bjork (°), angle N-S-Ar according to Bjork (°), ratio N-S:S-Ar' according to Bjork;

the second group - teleroentgenometric indicators, which can be used to change the width, length, angles and position of the upper and lower jaws with the help of orthognathic surgery (Fig. 1, 2);

the third group - teleroentgenometric indicators that characterize the position of each individual tooth relative to each other, cranial structures (Fig. 3) and the profile of the soft tissues of the face (Fig. 4, 5, 6).

In order to build models of teleroentgenometric indicators according to the COGS method, the method of step-by-step regression analysis in the license package "Statistica 6.0" was applied. When conducting this analysis, we observed the following conditions: 1) the final version of the regression equation must have a coefficient of determination R^2 of at least 0.60 (thus, the accuracy of the description of the modeled feature is at least 60.0 %); 2) the value of the F-criterion should be at least 2.5 (thus, the contribution of the variable to the total regression equation will be sufficiently significant); 3) the number of free members included in the regression equation should be as minimal as possible.

Results

Out of 33 possible, in Ukrainian YW with an orthognathic bite and a wide face type, 6 reliable regression equations of teleroentgenometric indicators were built, which were included in the *second* and *third* groups according to the COGS method, depending on the value of the indicators of the *first* group with a coefficient of determination greater than 0.60:

distance value N-ANS=8.132 + 0.259 x N-Se - 0.401 x P-PTV + 0.240 x S-Ar (R^2=0.705, $F_{(3.20)}$=15.93, p<0.001, Std.Error of estimate=1.423);

distance value ANS-Me=134.7 + 1.372 x N-CC - 0.985 x N-S - 1.211 x H + 0.626 x Ar-Pt + 0.446 x Por-NBa (R^2=0.601, $F_{(5.18)}$=5.43, p<0.01, Std.Error of estimate=2.637);

distance value 1l-MP=51.16 + 1.238 x N-CC - 0.355 x N-S - 0.517 x H + 0.162 x N-S-Ba - 0.575 x Pt-N (R^2=0.615, $F_{(5.18)}$=5.74, p<0.01, Std.Error of estimate=1.693);

angle value OP-HP=8.049 - 1.009 x P-PTV - 1.757 x N-CC + 0.520 x N-Se - 0.607 x Ar-Pt + 0.833 x Pt-N (R^2=0.661, $F_{(5.18)}$=7.01, p<0.001, Std.Error of estimate=2.611);

angle value Mand1-MP=70.46 + 4.197 x N-Se - 0.987 x S-Ar - 3.937 x N-S - 0.908 x P-PTV + 4.150 x N-S:S-Ar' (R^2=0.639, $F_{(5.18)}$=6.39, p<0.01, Std.Error of estimate=3.563);

distance value Ls-(Sn-Pog')=-4.875 - 0.683 x S-E + 0.121 x N-S-Ba - 0.150 x P-PTV (R^2=0.623, $F_{(3.20)}$=11.03, p<0.001, Std.Error of estimate=0.936);

where, here and in the following equations, R^2 - coefficient of determination; $F_{(!)}$=! - critical $_{(!)}$ and obtained (!) Fisher's test value; p - confidence level; Std.Error of estimate - standard error of estimate.

Coefficients of determination of the regression equations of the *distance values N-A* (R^2=0.278, p<0.05), *N-B* (R^2=0.314, p<0.01), *N-Pog* (R^2=0.479, p<0.01), *PNS-N* (R^2=0.365, p<0.01), *ANS-PNS* (R^2=0.391, p<0.01), *Go-Pog* (R^2=0.385, p<0.05), *B-Pog* (R^2=0.222, p<0.05), *A-B*

(R^2=0.122, p>0.05), *1u-NF* (R^2=0.210, p>0.05), *6u-NF* (R^2=0.582, p<0.001), *Gl'-Pog'* (R^2=0.288, p<0.01), *Li-(Sn-Pog')* (R^2=0.344, p<0.05) and *Stms-I* (R^2=0.447, p<0.05); *angles values N-A-Pog* (R^2=0.391, p<0.05), *Max1-NF* (R^2=0.359, p<0.05), *Gl'-Sn-Pog'* (R^2=0.126, p>0.05), *Sn-Gn'-C* (R^2=0.328, p<0.05) and *Cotg-Sn-Ls* (R^2=0.420, p<0.05); and *the values of the ratios Gl'-Sn/Sn-Me'* (R^2=0.575, p<0.001), *Sn-Gn'/C-Gn'* (R^2=0.103, p>0.05) and *Sn-Stms/Stmi-Me'* (R^2=0.576, p<0.001) in Ukrainian young women with a wide face type had a value of less than 0.60 and therefore have no significant value for practical dentistry. The regression equations of the *distance values Ar-Go, 6l-MP, Gl'-Sn, Sm-(Li-Pog')* and the *angles values MP-HP, Ar-Go-Gn* in Ukrainian young women with a wide face type are not constructed at all.

Out of 19 possible, in Ukrainian YW with an orthognathic bite and a wide face type, 16 reliable regression equations of teleroentgenometric indicators were built, which were included in the *third* group according to the COGS method, depending on the value of the indicators of the *first* and *second* groups with a coefficient of determination greater than 0.60:

distance value 1u-NF=7.181 + 0.399 x ANS-Me - 0.285 x N-Pog - 0.899 x S-Ar' - 0.364 x A-B + 0.260 x N-A + 0.839 x S-E - 0.214 x Por-NBa (R^2=0.889, $F_{(7.16)}$=18.38, p<0.001, Std.Error of estimate=0.842);

distance value 1l-MP=-16.20 + 0.502 x ANS-Me + 0.228 x N-A + 0.226 x N-CC + 0.077 x N-S-Ba + 0.094 x MP-HP (R^2=0.910, $F_{(5.18)}$=36.50, p<0.001, Std.Error of estimate=0.817);

distance value 6u-NF=23.43 + 0.333 x ANS-Me + 0.171 x N-CC - 0.356 x PNS-N - 0.111 x N-S-Ba - 0.075 x N-B (R^2=0.821, $F_{(5.18)}$=16.47, p<0.001, Std.Error of estimate=0.867);

distance value 6l-MP=2.511 + 0.358 x ANS-Me + 0.284 x Ar-Go - 0.185 x P-PTV - 0.118 x Ar-Go-Gn + 0.122 x N-A-Pog (R^2=0.878, $F_{(5.18)}$=25.86, p<0.001, Std.Error of estimate=0.887);

angle value OP-HP=0.162 + 0.843 x N-Pog - 1.637 x A-B + 0.732 x N-A-Pog - 1.593 x N-B (R^2=0.983, $F_{(4.19)}$=271.0, p<0.001, Std.Error of estimate=0.573);

angle value Max1-NF=32.62 + 0.985 x N-B + 0.979 x Go-Pog + 0.702 x ANS-PNS - 0.674 x Ar-Go - 0.893 x PNS-N + 1.044 x N-ANS (R^2=0.691, $F_{(6.17)}$=6.33, p<0.01, Std.Error of estimate=3.527);

angle value Mand1-MP=83.80 + 0.394 x N-Se + 0.609 x N-A-Pog - 1.613 x MP-HP - 0.562 x N-Pog + 0.984 x ANS-PNS - 0.681 x Ar-Go (R^2=0.868, $F_{(6.17)}$=18.65, p<0.001, Std.Error of estimate=2.218);

angle value Gl'-Sn-Pog'=7.836 + 0.741 x N-A-Pog - 0.339 x N-B (R^2=0.614, $F_{(2.21)}$=16.69, p<0.001, Std.Error of estimate=3.870);

distance value Gl'-Sn=-15.99 + 0.832 x N-A + 0.400 x N-CC (R^2=0.654, $F_{(2.21)}$=19.86, p<0.001, Std.Error of estimate=2.137);

distance value Gl'-Pog'=23.41 + 0.914 x N-Pog - 0.167 x N-S-Ba (R^2=0.917, $F_{(2.21)}$=116.0, p<0.001, Std.Error of estimate=1.670);

value of the ratio Gl'-Sn/Sn-Me'=76.18 + 2.992 x Pt-N - 1.867 x Por-NBa - 1.201 x ANS-Me (R^2=0.694, $F_{(3.20)}$=15.15, p<0.001, Std.Error of estimate=7.071);

value of the ratio Sn-Gn'/C-Gn'=105.9 + 2.496 x ANS-Me - 7.267 x N-B - 6.771 x N-ANS + 4.127 x PNS-N + 4.977 x N-A - 2.326 x MP-HP (R^2=0.710, $F_{(6.17)}$=6.93, p<0.001, Std.Error of estimate=13.37);

angle value Cotg-Sn-Ls=112.9 + 5.669 x B-Pog + 1.076 x N-A-Pog + 1.612 x S-Ar - 0.455 x Ar-Go-Gn - 0.698 x ANS-Me (R^2=0.640, $F_{(5.18)}$=6.40, p<0.01, Std.Error of estimate=5.728);

distance value Ls-(Sn-Pog')=1.417 + 0.077 x N-A-Pog - 0.475 x S-E + 0.098 x N-S-Ba - 0.326 x B-Pog (R^2=0.806, $F_{(4.19)}$=19.75, p<0.001, Std.Error of estimate=0.689);

distance value Li-(Sn-Pog')=-11.13 + 0.144 x N-A-Pog - 0.475 x Ar-Pt + 0.115 x N-S-Ba + 0.317 x ANS-PNS - 0.591 x B-Pog (R^2=0.829, $F_{(5.18)}$=17.50, p<0.001, Std.Error of estimate=0.906);

value of the ratio Sn-Stms/Stmi-Me'=90.02 - 1.116 x Pt-N + 1.488 x B-Pog + 0.341 x MP-HP + 0.543 x Por-NBa (R^2=0.709, $F_{(4.19)}$=11.57, p<0.001, Std.Error of estimate=3.409).

Coefficients of determination of the regression equations of the *distances Sm-(Li-Pog')* (R^2=0.437, p<0.01) and *Stms-I* (R^2=0.455, p<0.05); angle *value Sn-Gn'-C* (R^2=0.389, p<0.05) in Ukrainian young women with a wide face type had a value of less than 0.60 and therefore have no significant value for practical dentistry.

Discussion

Thus, in Ukrainian YW with an orthognathic bite and a wide facial type, using the "Cephalometrics for orthognathic surgery" method, 6 reliable regression models of teleroentgenometric indicators were built out of 33 possible, which are included in the *second* and *third* groups depending on the indicators of the *first* group with a coefficient of determination greater than 0.60 (R^2= from 0.601 to 0.705, p<0.01-0.001). Most often, these regression equations include: the distance P-PTV (15.38 %) and N-CC (11.54 %) according to Ricketts, N-Se according to Schwarz (11.54 %), N-S (11.54 %) and S-Ar (7.69 %) according to Roth-Jarabak, Ar-Pt and Pt-N according to the COGS method (7.69 % each), as well as the value of the angles H according to Schwarz and N-S-Ba according to Bjork (7.69 % each).

Also, in Ukrainian YW with an orthognathic bite and a wide facial type, using the "Cephalometrics for orthognathic surgery" method, 16 reliable regression models of teleroentgenometric indicators were built out of 19 possible, which are included in the *third* group depending on the indicators of the *first* and *second* groups with a coefficient of determination greater than 0.60 (R^2 = from 0.614 to 0.983, p<0.01-0.001). Most often, these regression equations include: ANS-Me distances (9.86 %), N-B (7.04 %), N-A, N-

Pog and B-Pog (5.63 % each), N-CC according to Ricketts, PNS-N, Ar -Go and ANS-PNS (4.23 % each), as well as the value of the angles N-A-Pog (9.86 %), N-S-Ba according to Bjork (7.04 %), MP-HP (5.63 %) and Por-NBa according to Ricketts (4.23 %).

The establishment of ethnic characteristics and other variables that can influence changes in normative indicators of odontometric parameters is actively conducted in various scientific institutions [26, 29]. In the study of Amjad Al Taki et al. [1], 71 lateral cephalometric images were analyzed according to the Legan-burstone method of Circassian adults with normal occlusion. The results showed that Circassians have a more convex facial profile, a setback lower jaw and an increased nasolabial angle compared to Caucasians.

The researchers measured 25 anthropometric variables according to the Holdaway-Burstone method in 25 Iranian men and 25 women with good occlusion and balanced faces. Statistical analysis showed significant differences between men and women in several parameters, such as chin-neck angle, nasolabial angle, Merrifield Z-angle, facial convexity angle, thickness of soft tissues of the chin and upper lip, respectively, not all Holdaway norms can be applied to the Iranian population [3]. Another study of Iranians using different cephalometric methods identified significant characteristics of attractive profiles, which were compared with norms for Caucasians. It was found that such indicators as the angle of the soft tissues of the face, the protrusion of the nose, the curve of the upper lip, the nasolabial angle and others have statistical significance in the formation of attractive profiles. Age and sex did not affect the attractiveness of profiles [14].

A study of 100 Egyptian adults aged 18-25 years showed that, according to Holdaway-Burstone analysis, their faces are more convex, their lips are more prominent, and their nasolabial angles are sharper compared to white population standards. Men had more convex faces and protruding lips than women [4].

Teleroentgenograms of 100 Kurds were analyzed using Holdaway and Legan-Burstone cephalometry methods. According to the Holdaway analysis, Kurds have a significantly smaller angle of soft facial tissues, nose protrusion, and thickness of the upper lip compared to Caucasians. At the same time, the values of such parameters as the angle of the face, the convexity of the skeleton, the thickness of the upper lip, and others, turned out to be significantly greater in Kurds [17].

50 individuals aged 18 to 30 years from the southern states of India were subjected to lateral cephalometric analysis according to Burston and Legan. The South Indian population had increased mandibular protrusion, lower lip, upper lip, and deep mentolabial sulcus in both males and females compared to the norm. An increase in the angle between the lower part of the face and the neck was observed in men from southern India [24].

Maharashtrian men have a straighter profile, lower vertical height and reduced mandibular deviation compared to Caucasian men, while Maharashtrian women have a convex profile, reduced vertical height and reduced mandibular deviation according to COGS analysis [20].

Significant progress in the study of teleroentgenometric parameters was achieved by Ukrainian scientists when working with local populations. Thus, the peculiarities of the craniotype and facial types of men from different regions of Ukraine were established [15], the peculiarities of teleradiographic parameters according to the method of Schwarz A. M. were investigated, in particular, the parameters of the root length of the incisors and canines of the upper and lower jaws, models were created for building the correct shape of the teeth arches in young men with a wide face depending on the characteristics of odontometric and cephalometric indicators. In general, in most works, special importance was attached to the study of the relationships between the investigated odontometric parameters and the types of the faces of the examinees [21, 22, 23].

93 lateral cephalometric images of Ukrainian adolescents with a normal bite were studied and discrepancies were found in the position of the central incisors of the upper and lower jaws depending on the ANB angle compared to the results of S.S. Steiner. Reliable incisor position models for Ukrainian teenagers were built using Steiner's method, and the coefficient of determination for boys was from 0.542 to 0.796, and for girls - from 0.503 to 0.622. The study confirmed the relationship of the ANB angle with the characteristics of the position of the upper and lower incisors and revealed ethnic differences [8].

Conclusion

1. With a coefficient of determination higher than 0.60 in YW with an orthognathic bite and a wide face using the COGS method, 6 regression models of teleroentgenometric indicators were built out of 33 possible, which were included in the second and third groups depending on the indicators of the first group (R^2= from 0.601 to 0.705) and out of 19 possible - 16 indicator models that were included in the third group depending on the indicators of the first and second groups (R^2= from 0.614 to 0.983).

2. In YW with an orthognathic bite and a wide face, the values of the distances P-PTV (15.38 %) and N-SS (11.54 %) are most often among the indicators of the *first* group, which were included in the models of indicators of the *second* and *third* groups according to the COGS method Ricketts, N-Se by Schwarz (11.54 %) and N-S by Roth-Jarabak (11.54 %); and among the indicators of the *first* and *second* groups that were included in the models of indicators of the *third* group - the value of the distances ANS-Me (9.86 %), N-B (7.04 %), N-A, N-Pog and B-Pog (5.63 % each), as well as the value of the angles N-A-Pog (9.86 %), N-S-Ba by Bjork (7.04 %) and MP-HP (5.63 %).

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МОДЕЛЮВАННЯ ІНДИВІДУАЛЬНИХ ТЕЛЕРЕНТГЕНОМЕТРИЧНИХ ПОКАЗНИКІВ ЗА МЕТОДОМ "CEPHALOMETRICS FOR ORTHOGNATHIC SURGERY" В УКРАЇНСЬКИХ ДІВЧАТ ІЗ ШИРОКИМ ТИПОМ ОБЛИЧЧЯ ТА ОРТОГНАТИЧНИМ ПРИКУСОМ

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Дослідження індивідуальних нормативних цефалометричних параметрів у осіб різної статі і віку є важливим для методу "Cephalometrics for orthognathic surgery", оскільки дозволяє точно діагностувати аномалії та розробляти персоналізовані плани лікування. Це сприяє досягненню кращих естетичних результатів, знижуючи ризик ускладнень і підвищуючи ефективність хірургічних втручань. Врахування вікових, статевих особливостей, типу обличчя допомагає прогнозувати довгострокові зміни та адаптувати план лікування для отримання оптимальних результатів. Крім того, це підвищує точність оцінки і стандартизує науково обґрунтовані підходи, що полегшує порівняння результатів між клініками. Таким чином, індивідуальні нормативні параметри є ключовими для успішної ортогнатичної хірургії. Мета дослідження - побудова та аналіз регресійних моделей телерентгенометричних показників за методикою "Cephalometrics for orthognathic surgery" в українських дівчат із широким типом обличчя. 25 українським дівчатам із ортогнатичним прикусом і широким типом обличчя проведено цефалометричне дослідження за методикою "Cephalometrics for orthognathic surgery" (COGS-метод). Для коректного моделювання цефалометричних параметрів застосовано їх розподіл на три групи (Дмітрієв М. О., 2016, 2017): перша група - базові метричні характеристики черепа; друга група - телерентгенометричні показники за якими за допомогою ортогнатичної хірургії можливо змінювати параметри верхньої та нижньої щелеп; третя група - показники які характеризують положення кожного зуба відносно один одного, черепних структур та профілю м'яких тканин обличчя. Побудова регресійних моделей проведена в ліцензійному пакеті "Statistica 6.0". Подальшому аналізу підлягали лише достовірні моделі з коефіцієнтом детермінації R^2 не менше 0,60. Встановлено, що у дівчат із широким обличчям за COGS-методом із 33 можливих побудовано 6 моделей телерентгенометричних показників які увійшли до другої та третьої груп в залежності від показників першої групи (R^2= від 0,601 до 0,705, p<0,01-0,001), а також із 19 можливих побудовано 16 моделей показників, які увійшли до третьої групи в залежності від показників першої та другої груп (R^2= від 0,614 до 0,983, p<0,01-0,001). Аналіз моделей показав, що найчастіше до регресійних рівнянь показників які увійшли до другої та третьої груп в залежності від показників першої групи входять величина відстаней P-PTV і N-CC за Ricketts, N-Se за Schwarz, N-S і S-Ar за Roth-Jarabak, Ar-Pt і Pt-N за COGS-методом (по 7.69 %), а також величина кутів H за Schwarz і N-S-Ba за Bjork; а до моделей показників які увійшли до третьої групи в залежності від показників першої та другої груп - величина відстаней ANS-Me, N-B, N-A, N-Pog, B-Pog, N-CC за Ricketts, PNS-N, Ar-Go і ANS-PNS, а також величина кутів N-A-Pog, N-S-Ba за Bjork, MP-HP, а також Por-NBa за Ricketts.

Ключові слова: *регресійний аналіз, телерентгенографія, цефалометрія за методикою "Cephalometrics for orthognathic surgery", дівчата, типи обличчя, ортогнатичний прикус.*

Author's contribution

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Karpenko I. A. - validation.
Datsenko G. V. - review writing and editing.
Prokopenko S. V. - review writing and editing.
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