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CORRELATIONS OF TELEROENTGENOGRAPHIC PARAMETERS OF THE JAWS WITH BASIC CRANIOMETRIC PARAMETERS IN JUVENILE MEN AND JUVENILE WOMEN WITH ORTHOGNATHIC BITE AND DIFFERENT FACIAL TYPES ACCORDING TO SCHWARZ A.M.

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Peculiarities of correlations between TRG indicators of the upper and lower jaws, inter-jaw indicators, and TRG indicators of the skull in Ukrainian young men and young women with orthognathic bite with different facial types according to Schwarz A. M. were established. In young men with the first type of face (back type), the revealed reliable correlations were mostly direct strong and medium strength, in young women – almost the same number of direct and reverse correlations of medium strength. In young men with the second type of face (average type), reliable correlations were mostly direct of medium strength and strong, and in young women – mostly inverse of medium strength. In young men with the third type of face (front type), the number of direct and reverse correlations of mostly average strength did not differ significantly, and in young women, direct correlations prevailed among the average strength of correlations.

Key words: teleradiography, cephalometry, craniometric and gnathometric indicators, face types, orthognathic occlusion, correlations.

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КОРЕЛЯЦІЇ ТЕЛЕРЕНТГЕНОГРАФІЧНИХ ПОКАЗНИКІВ ЩЕЛЕП ІЗ БАЗОВИМИ КРАНІОМЕТРИЧНИМИ ПОКАЗНИКАМИ В ЮНАКІВ І ДІВЧАТ З ОРТОГНАТИЧНИМ ПРИКУСОМ ІЗ РІЗНИМИ ТИПАМИ ОБЛИЧЧЯ ЗА A.M. SCHWARZ

Встановлені особливості кореляцій між ТРГ-показниками верхньої і нижньої щелеп, міжщелепними показниками та ТРГ-показниками черепа в українських юнаків і дівчат із ортогнатичним прикусом із різними типами обличчя за Schwarz A. M.. В юнаків із першим типом обличчя (задній тип) виявлені достовірні зв'язки були переважно прямими сильними та середньої сили, у дівчат – майже однакова кількість прямих та зворотних зв'язків середньої сили. В юнаків з другим типом обличчя (середній тип) достовірні зв'язки були переважно прямими середньої сили та сильними, а у дівчат – переважно зворотніми середньої сили. В юнаків з третім типом обличчя (передній тип) кількість прямих та зворотніх зв'язків переважно середньої сили суттєво не відрізнялася, а в дівчат серед середньої сили зв'язків переважали прямі.

Ключові слова: телерентгенографія, цефалометрія, краніометричні та гнатометричні показники, типи обличчя, ортогнатичний прикус, кореляції.

The study is a fragment of the research project "Optimizing diagnosis, orthopedic treatment and prevention of pathology of the dento-jaw system", state registration No. 0119U103951.

In modern conditions, the practical activity of orthopedic doctors, orthodontists, maxillofacial surgery specialists are impossible without determining and taking into account the patient's cephalometric parameters. Among the research methods used to establish such indicators, one of the most widespread and informative is the teleroentgenography method, which allows obtaining high-quality standardized images and determining the quantitative characteristics of cranial and gnathic structures and soft tissues of the human face [7, 9, 10, 13].

Over the decades, numerous author's methods of cephalometric analysis have been developed, which are widely used to this day. But there is still no universally recognized and universal method of cephalometric analysis, which is due to a number of reasons, in particular, different contingents of the population, the indicators of which formed the basis of the normative values of different methods, differences in the approaches of the authors to the determination of individual cephalometric indicators in the methods, changes in the anthropometric characteristics of patients, the popularity of various methods of analysis among doctors of different countries, etc. [4, 5, 8, 14].

All this determined the relevance of further research both in terms of determining the normative cephalometric indicators of various methods of cephalometric analysis, and establishing the peculiarities of their correlations in the population of different age groups, sexes, ethnic groups and populations [4, 5, 6, 15].

The purpose of the study was to establish relationships between linear and angular indicators of the jaws and basic craniometric parameters in juvenile residents of Ukraine with an orthognathic bite and with different types of face according to Schwarz.

Materials and methods. Lateral teleroentgenograms of 76 young women (YW) aged 16 to 20 years and 49 young men (YM) aged 17 to 21 years with a physiological occlusion as close as possible to

orthognathic (hereinafter referred to as orthognathic occlusion) were studied using a Veraviewepocs 3D Morita (Japan) dental cone-beam tomograph.

The Biomedical Ethics Committee of the National Pirogov Memorial Medical University, Vinnytsya (protocol No. 8 of September 30, 2021) found that the conducted research meets bioethical and moral and legal requirements, the relevant provisions of the WHO and the laws of Ukraine.

Both YM and YW were divided into 3 groups of people with different face types according to Schwarz A. M. (1961): 1 face type (back face type, face angle F up to 83°) – 13 YM and 23 YW; 2 face type (average face type, face angle F 84-87°) – 18 YM and 24 YW; 3 face type (front face type, front angle F>87°) – 18 YM and 29 YW.

The analysis of TRG indices was performed using the licensed medical software OnyxCeph³™, version 3DPro (Germany, software license No. URSQ-1799). Cephalometric points were determined according to the recommendations of Phulari B. S. [12]. Measurements were carried out according to the recommendations of Schwarz A. M. (1961).

The studied TRG indices were divided into 2 groups according to the recommendations of Dmitriev M. O. [1]. The first group includes craniometric indices, which usually do not change during surgical and orthodontic treatment, but are used as basic indices in the methods of cephalometric analysis, relative to which. determine the slope, vertical or anterior-posterior position of the gnathic structures: N-Se distance – length of the front part of the skull base (mm); angle H – angle of inclination of the Frankfurt plane to the base of the skull (°); N-S-Ar angle – saddle angle (°); angle N-S-Ba – formed by the lines S-N (front part of the base of the skull) and S-Ba (°); indicator N-S:S-Ar' – indicator of the ratio of distances ar'-S and N-S; N-S distance – length of the anterior cranial base (mm); distance S-ar – length of lateral cranial base (mm); the S-ar:ar-Go index is an index of the ratio of the S-ar and ar-Go distances; distance S-E – length of the back part of the base of the skull (mm); ar-Go distance – the length of the branch of the lower jaw according to Burstone C. J. (mm); angle POr-NBa – angle of cranial inclination (deflection) (°); distance N-CC – anterior length of skull base (mm) and distance P-PTV – distance from point Po to point Pt, parallel to the Frankfurt plane (mm).

The second group included TRG-indices of the maxillofacial apparatus according to Schwarz A. M., the definition of which is most often used during surgical and orthodontic interventions in patients who are in the process of growth or have an already formed bone skeleton and which can be changed in length, width, angles and location of the jaws: distance Max – length of the upper jaw (mm); distance Length of Mand. – length of the lower jaw (mm); distance R.asc. – length of the branch of the lower jaw (mm); angle F – face angle (°); angle I – inclination angle (°); angle G – gonial angle (°), angle B – basal angle (°); angle MM – maxillary-mandibular angle (°); angle T – profile angle T (°).

Correlations between TRG indices of the second and first groups were determined in the licensed statistical package "Statistica 6.0" using the non-parametric Spearman method.

Results of the study and their discussion. In young men with the first type of face according to Schwarz A. M., reliable correlations were established between TRG indices of the second group (indices of the upper and lower jaws, inter-jaw indices) and the first group (basic craniometric indices): strong straight correlations – distances Length of Mand. with the value of the N-Se (r=0.79) and N-S (r=0.61) distances; the Max distance with the value of the N-Se (r=0.61) and S-E (0.72) distances; distance R.asc. with the value of the distances S-E (r=0.64) and ar-Go (r=0.60) and the value of the angle I with the distance S-ar (0.61); strong inverse – distance R.asc. with the S-ar:ar-Go indicator (r=-0.76); of average strength straight correlations – angles B and G with the angle POr-NBa (respectively, r=0.56 and r=0.50), distances Max and R.asc. with the value of the angle N-S-Ar (respectively, r=0.58 and r=0.58) and the angle I with the value of the distance S-E (r=0.59); of the average force are the inverses of the angle B with the distance N-CC (r=-0.58), the angle G with the distance N-Se (r=-0.55) and the distance R.asc. with the index N-S:S-Ar' (r=-0.58). Also in young men with the first type of face according to Schwarz A. M. numerous unreliable direct (r= from 0.30 to 0.52) and inverse (r= from -0.31 to -0.55) correlations were established between the TRG indices of the second and first groups.

In YW with the first type of face according to Schwarz A. M., there are reliable connections between these groups of TRG indices: strong straight – R.asc distances. with the value of the ar-Go distance (r=0.68) and the Length of Mand. distance with the value of the N-CC distance (r=0.65); of medium strength straight line – angle B with the index S-ar:ar-Go (r=0.55), distance Length of Mand. with the value of the N-Se (r=0.54) and N-S (r=0.53) distances, the Max distance with the value of the N-S-Ar (r=0.46), N-S-Ba (r=0.43) angles and with the value of the S-E distance (r=0.43), distances R.asc. with the value of the S-ar (r=0.51) and N-CC (r=0.47) distances and the MM angle with the S-ar:ar-Go index (r=0.47); the inverse of the mean force is the angle B with the distance ar-Go (r=-0.55) and the angle G with the distance P-PTV (r=-0.52), the distance Max with the index N-S:S-Ar' (r=-0.47), angle MM with the value of the angles H and N-S-Ar (respectively, r=-0.56 and r=-0.43) and the value of the distances ar-Go (r=-0.51) and P-PTV (r=-0.42), angle I with the value angles N-S-Ar (r=-0.54) and N-S-Ba (r=-0.45) and angle T with the value of the N-CC distance (r=-0.51). Also, in YW with the first type of face according to Schwarz

A. M., few medium strength unreliable direct (r= from 0.30 to 0.40) and inverse (r= from -0.30 to -0.41) correlations between TRG indices of the second and first groups were found.

According to the results of our quantitative analysis of reliable correlations in YM and YW with an orthognathic bite with the first type of face according to Schwarz A. M., the following distribution was established between the TRG indices of the second and first groups: in YM – a total of 16 correlations out of 117 possible (13.7 %) of which strong direct 6.0 %, average strength direct 4.3 %, strong reverse 0.9 %, mean strength reverse 2.6 %; in YW – a total of 21 out of 117 possible (17.9 %), of which 1.7 % are strong forwards, 7.7 % average strength forwards, 8.5 % mean strength reverses.

Thus, in YW with the first type of face according to Schwarz A. M., a greater number of reliable correlations (by 31.2 %) between TRG indices of the second and first groups than in YM with the first type of face were established. Moreover, YM have mainly direct connections of strong and medium strength, and YW have almost the same number of direct and inverse correlations, almost all of which were of medium strength (with the exception of 2 strong direct correlations). In young men with the first type of face, among the TRG-indices of the second group, the largest number of reliable correlations with the TRG-indices of the first group was recorded in relation to the R.asc distance. (5 correlations – 2 strong straight, 1 medium strength straight, 1 strong reverse and 1 medium strength reverse) and Max distances (3 correlations – 2 strong straight and 1 medium strength straight), and in YW with the first type of face – angles MM (5 correlations – 4 average reverse forces and 1 average direct force) and Max distance (4 correlations – 3 average direct forces and 1 mean reverse force).

In young men with the second type of face according to Schwarz A. M., the following reliable relationships were established between the TRG indices of the second group and the first group: strong straight – distances Length of Mand. with the value of the ar-Go distance (r=0.62), Max distance with the N-Se (r=0.60), S-E (r=0.66), N-CC (r=0.70) and R.asc distances. with the value of the ar-Go distance (r=0.94); straight of mean strength – distances Length of Mand. with the value of the N-Se (r=0.56) and N-S (r=0.53) distances, the Max distance with the value of the N-S distance (r=0.57), the R.asc distance. with the value of the N-Se distance (r=0.50) and the value of the angle H (r=0.50); strong inverses are R.asc distances. with the index S-ar:ar-Go (r=-0.74) and the MM angle with the index N-S:S-Ar' (r=-0.63); of the mean force are inverse of the angle G with the value of the distance ar-Go (r=-0.56), the distance Length of Mand. with the S-ar:ar-Go index (r=-0.49) and with the value of the P-PTV distance (r=-0.53), the Max distance with the N-S:S-Ar' indicator (r=-0.52) and the R.asc distance with the value of the P-PTV distance (r=-0.57). It should also be noted that in young men with the second type of face according to Schwarz A. M., the presence of a small number of unreliable direct (r= from 0.31 to 0.46) and inverse (r= from -0.31 to -0.44) correlations between the TRG indicators of the second and first groups.

In YW with the second type of face according to Schwarz A. M., the following reliable relationships were established between the TRG indices of the second and first groups: strong straight – Max distances with the value of the N-Se (r=0.80), N-S (r=0.83) and R.asc distances with the value of the ar-Go distance (r=0.87); strong inverses – R.asc distances. with the P-PTV index (r=-0.65); of mean strength are straight – Max distances with the value of S-ar and N-CC distances (respectively, r=0.41 and r=0.59), R.asc distances. with the value of the S-E distance (r=0.45) and the T angle with the S-ar:ar-Go index (r=0.42); the inverse of the mean force – angle B with the distance S-Ar (r=-0.44) and with the distance ar-Go (r=-0.54), angle G with the distance ar-Go (r=-0.44), distance Max with the value of the angles N-S -Ar and N-S-Ba (r=-0.46 and r=-0.40, respectively), angles I with angles H (r=-0.51) and POr-NBa (r=-0.49) and with the index S-ar:ar- Go (r=-0.45), angle T with the distance ar-Go (r=-0.58). Also, in YW with the second type of face, there were few unreliable direct (r= from 0.30 to 0.39) and inverse (r= from -0.33 to -0.38) correlations between the groups of the studied TRG indices.

According to the results of a quantitative analysis of reliable correlations in YM and YW with the second type of face according to Schwarz A. M., the following distribution was established between the TRG indices of the second and first groups: in YM – a total of 18 correlations out of 117 possible (15.4 %), with which strong direct 4.3 % and strong reverse 1.7 %, average strength of direct 5.1 %, mean strength of reverse 4.3 %; in YW – a total of 17 out of 117 possible (14.5 %), of which strong direct 2.6 %, average strength direct 3.4 %, strong reverse 0.9 %, mean strength reverse 7.7 %.

Thus, YM and YW with the second type of face according to Schwarz A. M. recorded almost the same number of correlations between the TRG indicators of the second and first groups. Moreover, among young men, reliable correlations were mostly direct of medium strength and strong, and among YW – reverse connections of medium strength prevailed. In young men with the second type of face, among the TRG-indices of the second group, the largest number of reliable correlations with the TRG-indicators of the first group (5 correlations each) was recorded regarding the Length of Mand. distance (1 strong straight, 2 medium strength straights and 2 medium strength reverses), Max distances (3 strong straights, 1 medium strength straight and 1 medium strength reverse) and R.asc distances. (1 strong straight, 2 medium strength straights, 1 strong reverse and 1 medium strength reverse). In YW, the largest number of correlations is

established in relation to the Max distance (6 connections – 2 strong straight lines, 2 medium strong straight and 2 medium strong reverse lines).

In young men with the third type of face according to Schwarz A. M., the following reliable correlations were established between the TRG indices of the second and first groups: a strong straight – distances R.asc. with the value of the ar-Go distance (r=0.67); strong reverse – distance Length of Mand. with the value of the P-PTV distance (r=-0.62); of mean strength straight – distances Length of Mand. and Max with the value of the distances N-S (respectively, r=0.49 and r=0.59) and N-CC (respectively, r=0.57 and r=0.50) and the mean force of the reverse angle B with the value of the distances N-S (r=-0.57) and N-CC (r=-0.49) and the T angle with the value of the N-Se (r=-0.50), N-S (r=-0.51) and S-Ar (r=-0.52) distances. Also, in young men with the third type of face, few unreliable direct (r= from 0.31 to 0.47) and inverse (r= from -0.30 to -0.43) correlations were noted.

In YW with the third type of face according to Schwarz A. M., the following reliable correlations were found between these groups of indices: strong straight– distances Length of Mand. with the value of the N-Se (r=0.61) and N-S (r=0.67) distances, the angle F with the value of the N-S:S-Ar' index (r=0.61) and the angle I with the value of the S-Ar distance (r=0.60); strong inverses – of the F angle with the value of the H angles (r=-0.65), N-S-Ar (r=-0.69) and N-S-Ba (r=-0.64); of average strength of straight – angle G with angle H (r=0.40), distance Length of Mand. with the value of the N-CC distance (r=0.54), the Max distance with the value of the N-Se (r=0.46), N-S (r=0.50), N-CC (r=0.52), R.asc distances. with the value of the distances N-S (r=0.47), S-E (r=0.40), ar-Go (r=0.48), N-CC (r=0.47) and the value of the angle POr-NBa (r=0.53), the angle F with the value distance P-PTV (r=0.52), angle I with the value of the index N-S:S-Ar' (r=0.43) and angle T with the value of the angles H (r=0.50), N-S-Ar (r=0.51) and N-S- Ba (r=0.48); of the mean force are the inverses of angle B with distance (r=-0.43), angle G with distances N-Se (r=-0.40) and N-S (r=-0.50), distances Max and R.asc. with the value of the S-ar:ar-Go index (r=-0.44 and r=-0.41, respectively), the angle F with the value of the distance S-E (r=-0.56), the angle I with the value of the angles N-S-Ar and N-S-Ba (respectively, r=-0.59 and r=-0.57), of the T angle with the value of the N-S:S-Ar' index (r=-0.42) and the value of the N-Se and N-S distances (r=-0.37 in both cases). In addition, in YW with the third type of face, single unreliable direct (r= from 0.33 to 0.35) and inverse (r= from -0.32 to -0.37) correlations between TRG indices of these groups were established.

In young men and women with an orthognathic bite with the third type of face according to Schwarz A. M., based on the results of a quantitative analysis of reliable correlations between TRG indicators of the second and first groups, the following distribution of correlations was found: in young men, a total of 11 connections out of 117 possible (9.4 %), which is the smallest index among all the studied groups of young men and women with different types of faces, of which strong straight and strong reverse faces – 0.9 % each, mean strength of straight faces 3.4 % and mean strength of reverse faces – 4.3 %. YW have a total of 34 out of 117 possible (29.1 %), which is the largest indicator of all studied groups of YM and YW, of which strong direct 3.4%, average direct power 12.8 %, strong reverse 3.4 %, mean reverse power 9.4 %.

Thus, in young men with the third type of face, almost the same number of reliable direct and reverse correlations of mostly medium strength were established between the TRG indices of the second and first groups. In YW, direct correlations slightly prevailed over reverse connections due to a greater number of correlations of medium strength.

It should be noted that significant attention is paid to the study of the correlations between TRG indicators according to various methods of cephalometric analysis in the population of Ukraine, taking into account the peculiarities of the craniotype and face type, and it is generally accepted to distinguish separate groups of cephalometric indices according to Dmitriev M. O. [1], as and in our study [3, 13, 14].

V. V. Vakhovskyi and others. [14] investigated the correlations of TRG indicators of group 2 and group 1, determined by the methods of Jarabak and Bjork, in Ukrainian YM and YW with an orthognathic bite. According to the Bjork method, significantly more reliable correlations were found in YW than in YM, as in our study. In YM, feedback correlations of mean strength were established, while in YW, the number of mean strength of direct and feedback correlations practically did not differ. At the same time, when using Jarabak's cephalometric analysis, the number of reliable connections in YM and YW practically did not differ, and in YM, direct connections of mean strength and inverse connections of mean strength prevailed, and in YW – inverse weak correlations.

The need to take into account the features of the craniotype, type and profile of a person's face in the study of cephalometric TRG-indicators, indices of the maxillofacial apparatus and soft tissues of the face has been proved. Thus, Moroz V. M. with co-authors [3], Dmitriev M. O. [1] established correlations of TRG-indicators of group 2 with indices of group 1 and correlations between indices of group 2 and group 3 (indices of the location of the teeth of the upper and lower jaws and the profile of the soft tissues of the face) in YM and YW with an orthognathic bite and determined their features in individuals of different sexes using the Steiner cephalometric analysis technique. A. V. Marchenko [2, 11] determined the peculiarities of correlations between the linear dimensions necessary for building the correct form of

the dental arch and odontometric and cephalometric indices in mesocephalic and brachycephalic YM and YW with an orthognathic bite.

Peculiarities of correlations of TRG-indices of the jaws (group 2) with basic cranial indices (group 1) in YM and YW with different facial profiles according to Schwarz A. M. [13] were established. As with the results of our presented study regarding individuals with different facial types, a greater number of reliable correlations were established in YW than in YM, while YM with different facial profiles showed the same number of correlations as in our study, and YW – smaller.

Thus, the discovery in our study of numerous quantitative and qualitative differences in the correlations of TRG-indices of the jaws and basic craniometric TRG-indices between groups of Ukrainian YM and YW with orthodontic bite indicates the need to take into account the group characteristics of people, in particular their face types, in order to obtain normative values. objective data that can be used during orthodontic surgical correction of dento-jaw deformities.

Conclusions

Reliable correlations were established between TRG indices of the upper and lower jaws and basic craniometric indices in YM and YW with an orthognathic bite and different facial types according to Schwarz A. M.:

1. In general, 1.6 times more correlations were established in YW than in YM: in YW with the third face type – 3.1 times more, in YW with the first face type – 1.3 times more, and the number of correlations in YM and YW with the second type of face practically did not differ.

2. Young men with the first type of face (back face type) have mainly direct correlations of strong and medium strength, while YW have almost the same number of direct and reverse connections, almost all of which were of medium strength; young men with the second type of face (average face type) have mainly direct and strong correlations of medium strength, while in YW – inverse correlations of medium strength prevailed; young men with the third type of face (front face type) have almost the same number of direct and reverse correlations of mostly medium strength. In YW, direct correlations slightly prevailed over reverse correlations due to a greater number of correlations of medium strength.

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