ISSN 1817-7883 eISSN 2522-9354

DOI: 10.31393/reports-vnmedical-2025-29(2)-09
УДК: 616.314.26:616.714.1-053.81-73.75

CORRELATIONS BETWEEN TELERADIOMETRIC INDICATORS ACCORDING TO THE STEINER METHOD AND THE SIZES OF TEETH AND DENTAL ARCHES IN UKRAINIAN YOUNG MEN AND YOUNG WOMEN WITH PHYSIOLOGICAL OCCLUSION AND A WIDE FACIAL TYPE

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Received: April, 01, 2025; Accepted: May, 02, 2025.

Annotation. *Studying the features of craniofacial development in individuals with different facial types is important for optimizing orthodontic planning. Teleradiographic indicators according to the Steiner method allow us to assess the spatial relationships of the jaws, teeth, and soft tissues of the profile. The analysis of correlations between cephalometric characteristics, tooth sizes, and dental arch parameters in patients with harmonious occlusal development is relevant. This allows us to better understand the anatomical and functional patterns of the maxillofacial region in adolescence. The purpose of the study is to establish the features of the relationship between teleradiometric indicators according to the Steiner method with the sizes of teeth and dental arches in Ukrainian young men and young women with a physiological bite and a wide facial type. A morphometric study of computed tomography dimensions of teeth and dental arches was conducted and teleradiometric indices were determined using the Steiner method of primary computed tomography of 25 young men and 25 young women with physiological occlusion and a wide face type according to Garson, which were obtained from the data bank of the Department of Pediatric Dentistry and the Research Center of the National Pirogov Memorial Medical University, Vinnytsya. The assessment of correlations between teleradiometric indices using the Steiner method and computed tomography dimensions of teeth and dental arches was carried out in the licensed package «Statistica 6.0» using nonparametric Spearman statistics. As a result of the analysis of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the sizes of teeth and dental arches in young men and young women with a wide face type, it was established: in young men – 10.00% of similar correlations with the sizes of teeth of the upper jaw (mainly unreliable direct correlations of medium strength), 11.25% with the sizes of teeth of the lower jaw (mainly reliable and unreliable direct correlations of medium strength) and 13.89% with the sizes of dental arches (mainly reliable and unreliable direct correlations of medium strength); in young women – 18.75% of similar correlations with the sizes of the teeth of the upper jaw (mainly reliable and unreliable direct and unreliable reverse of average strength), 18.75% with the sizes of the teeth of the lower jaw (mainly reliable and unreliable direct and unreliable reverse of average strength) and 33.33% with the sizes of the dental arches (reliable and unreliable direct and reverse, mainly of average strength). Thus, in Ukrainian young men and young women with a physiological bite with a wide facial type, the peculiarities and gender differences of the relationships between teleradiometric indicators according to the Steiner method and computed tomography sizes of teeth and dental arches have been established.*

Keywords: *dentistry, teleradiometry according to the Steiner method, cone-beam computed tomography, teeth, dental arches, Ukrainian young men and young women, wide face type, physiological occlusion, correlations, sexual dimorphism.*

Introduction

Modern orthodontics considers the morphofunctional relationships of the maxillofacial region as a multicomponent system, which is formed under the influence of both hereditary and environmental factors. The prevalence of dentofacial anomalies remains significant worldwide, regardless of the age or ethnic origin of the patients. According to the data of the study among children aged 10-12 years, the frequency of orthodontic pathology reaches 61.4 % [3], which confirms the need for early diagnosis and treatment planning based on clear morphological landmarks. In the study of Carli E. et al. it was found that more than 50 % of school-age children need early orthodontic intervention [6], and other authors note the significant prevalence of incisors, retention, mesial bite and other disorders that affect the formation of the dentofacial system [2, 4, 10].

Assessment of the structure of the facial skeleton and jaws in patients with physiological occlusion of different anthropometric types makes it possible to identify patterns of the relationship between the parameters of the skull, teeth and occlusion. At the same time, there is data on the high frequency of additional (2.1 %) or impacted teeth (up to 4.4 %) among children and adolescents, detected using panoramic radiography [17, 22]. These phenomena can significantly affect the formation of the dental arch and its symmetry, especially in individuals with a wide facial type, which requires detailed morphometric analysis. J. H. Ku et al. (2022) indicate the prevalence of such anomalies as agenesis, microdontia and macrodontia among orthodontic patients, which also affects the measurements of the dental arches and requires appropriate consideration during diagnosis [10]. Of considerable scientific interest are teleradiometric indicators that allow quantitatively assessing the spatial relationships between the jaws, the skull base and the soft tissue profile. The Steiner method is considered one

of the most informative and standardized methods of such analysis, allowing comparisons between representatives of different age, gender and anthropological groups. According to the study of D. Klenke et al. (2023) conducted among adolescents and adults, radiological diagnostics allowed to identify morphological features that were not clinically manifested, but had potential significance for assessing the development of the bite and the shape of the jaws [9]. The study of H. Lathrop-Marshall et al. (2022) also indicated that occlusal disorders of the class III type can have a systemic impact, including speech disorders, which confirms the importance of an interdisciplinary approach to the study of such morphofunctional relationships [11].

The study of teleradiometric indicators in patients with physiological occlusion allows to establish reference parameters for a certain morphotype, in particular in individuals with a wide facial type. This is especially relevant given the fact that even in the absence of clinical pathology, imaging allows us to identify structural features that can serve as predictors of the development of disharmony in the future. The study by N. H. Bilge et al. (2018) showed that eruption anomalies, macrodontia, tooth displacement or their asymmetry can be detected even in outwardly «healthy» patients during a thorough radiological examination [4].

Thus, against the background of the high prevalence of dento-maxillofacial anomalies among children and adolescents, the study of the relationship between teleradiometric indicators according to the Steiner method and the sizes of teeth and dental arches in boys and girls with physiological occlusion will allow us to establish reliable diagnostic guidelines for further prevention and individualization of orthodontic intervention. Taking into account such morphological features in individuals with a wide facial type is an important step towards building anatomically and functionally justified treatment regimens that correspond to the ethnic and gender-age characteristics of patients [7].

The purpose of the study is to establish the characteristics of the relationship between teleradiometric indicators according to the Steiner method with the sizes of teeth and dental arches in Ukrainian young men and young women with a physiological bite and a wide facial type.

Materials and methods

Primary computed tomography scans of 25 Ukrainian young men (YM) (aged 17 to 21 years) and 25 Ukrainian young women (YW) (aged 16 to 20 years) with physiological occlusion and wide face type according to Garson, obtained from the data bank of the Department of Pediatric Dentistry and the Research Center of the National Pirogov Memorial Medical University, Vinnytsya. Teleradiographic and computed tomography studies were performed using a dental cone-beam tomograph Veraviewepocs 3D Morita (Japan) and Planmeca ProMax 3D Mid, manufactured by Planmeca OY (Finland) on the basis of the principle of voluntary informed consent in the private dental clinic «Vinintermed» and in the «Planmeca 3D Maxillofacial Diagnostics Center». The Bioethics Committee of the National Pirogov Memorial Medical University, Vinnytsya (protocol No. 7 dated 11/8/2022) established that the conducted research does not contradict the basic bioethical norms of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), relevant WHO provisions, and the laws of Ukraine.

Morphometric characteristics of lateral cephalometric radiographs according to the method of Steiner S. S. [21] were determined in the OnyxCeph³™ application, version 3DPro, from Image Instruments GmbH (Germany).

According to the Steiner method, the following angular (°) and linear (mm) indicators were determined [18]: angles SNA, SNB, ANB, SND, SN-OcP, SN-GoGn, II, Max1-NA, Max1-SN, Mand1-NB and distances 1u-NA, 1l-NB, Pog-NB, Holdaway Ratio, S-L, S-E.

Morphometric study of teeth and dental arches was performed using the software applications i-Dixel One Volume Viewer (Ver.1.5.0) J Morita Mfg. Cor, and Planmeca Romexis Viewer (ver. 3.8.3.R 15.12.14) Planmeca OY.

Since in previous studies [13], when comparing the computed tomography sizes of the same teeth on the right and left sides, no significant differences or trends were found, we use the average values of the corresponding teeth on the upper and lower jaws: 11 or 41 – upper or lower central incisors, 12 or 42 – upper or lower lateral incisors, 13 or 43 – upper or lower canines, 14 or 44 – upper or lower first premolars, 15 or 45 – upper or lower second premolars, 16 or 46 – upper or lower first molars.

Dental morphometry included determination of [18]: width of the coronal part of the corresponding teeth in the mesio-distal (MdK) and vestibulo-oral (VoK) planes; width of the cervical part of the corresponding teeth in the mesio-distal (MdC) and vestibulo-oral (VoC) planes; length of the corresponding teeth (same) in the mesio-distal and vestibulo-oral planes (MdLD); length of the coronal part of the corresponding teeth in the mesio-distal (MdLK) and vestibulo-oral (VoLK) planes; length of the root part of the corresponding teeth in the mesio-distal (MdLR) and vestibulo-oral (VoLR) planes.

Morphometry of the dental arches included determination of the following distances (mm) [18]: between the apical cusps (distance 13_23Bugr) and root tips (distance 13_23Apx) of the canines on the upper jaw and between the apical cusps (distance 33_43Bugr) and root tips (distance 33_43Apx) of the canines on the lower jaw; between the apices of the palatal (distance mapex_6), medial vestibular (distance napx_6), distal vestibular roots (distance dapx_6) and vestibular medial cusps (distance VestBM) of the upper first molars and the distal (distance dapx_46) and medial (distance mapx_46) roots of the lower first molars; between the premolar (distance PonPr) and molar (distance PonM) points after Pon; between the crowns of the central incisors and the lines connecting the canines (distance DL_C), first premolars (distance DL_F) and molars (distance DL_S) of the upper jaw; as well as the distances characterizing the position of the interdental (distance GL_1), premolar (distance GL_2) and molar (distance

GL_3) lines relative to the hard palate.

The correlations were assessed in the licensed package "Statistica 6.0" using non-parametric Spearman statistics.

Results. Discussion

As a result of the analysis of reliable and medium-strength unreliable relationships between *teleradiometric indicators according to the Steiner method with the sizes of the teeth of the upper jaw in YM with a wide facial type*, the following multiple correlations were found: medium-strength, mostly direct unreliable (r= from 0.30 to 0.50), correlations between the value of the Max1-SN angle and the width of the coronal part of the lateral incisors and first premolars, the length of the coronal part of the lateral incisors in the mesiodistal plane, the length of the root part of the central and lateral incisors, the width of the cervical part of the lateral incisors in the vestibulo-oral plane, the length of the lateral incisors; medium strength, mostly direct, unreliable (r= from 0.32 to 0.51), correlations between the value of the 1u-NA distance and the length of the coronal part of the lateral incisors, the width of the coronal part of the first molars in the mesio-distal plane, the length of the root part of the central and lateral incisors and canines, the width of the cervical part of the lateral incisors in the vestibulo-oral plane, the length of the lateral incisors and first premolars; medium strength, direct, mostly unreliable (r= from 0.30 to 0.50), correlations between the value of the Pog-NB distance and the width of the coronal part of the central incisors and first molars, the length of the coronal part of the lateral incisors in the vestibulo-oral plane, the length of the coronal part of the canines, the width of the coronal part of the first molars in the mesio-distal plane, the length of the first premolars; medium-strength reliable and unreliable direct (r= from 0.38 to 0.56) and inverse (r= from -0.33 to -0.40) correlations between the size of the Max1-NA angle and the length of the crown part of the central and lateral incisors in the mesio-distal plane, the length of the root part of the central and lateral incisors in the vestibulo-oral plane (direct), the length of the crown part of the central incisors and canines in the vestibulo-oral plane, the length of the root part of the canines in the mesio-distal plane (inverse). With the sizes of the teeth of the upper jaw in YM with a wide facial type, no reliable or medium-strength unreliable relationships were established with the size of the SNA, SN-GoGn angles and the S-L distance according to the Steiner method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the sizes of the upper jaw teeth in YM with a wide face type revealed 56 relationships out of 560 possible (10.00 %), of which 1.79 % were reliable direct relationships of medium strength, 6.07 % were unreliable direct relationships of medium strength, 0.36 % were reliable inverse relationships of medium strength, and 1.79 % were unreliable inverse relationships of medium strength.

As a result of the analysis of reliable and medium-strength unreliable relationships *between teleradiometric indicators according to the Steiner method with the sizes of the teeth of the lower jaw in YM with a wide facial type*, the following multiple correlations were found: mainly medium-strength direct reliable (r= from 0.30 to 0.61), correlations between the value of the Max1-NA angle and the length of the coronal part of the central and lateral incisors in the mesiodistal plane, the length of the root part of the central and lateral incisors and canines in the vestibulo-oral plane, the length of the central incisors; medium strength, mostly direct reliable (r= from 0.33 to 0.46), correlations between the value of the Max1-SN angle and the length of the coronal part of the central and lateral incisors, the width of the coronal part of the central incisors in the mesio-distal plane, the length of the root part of the central and lateral incisors in the vestibulo-oral plane; medium strength, mostly direct unreliable (r= from 0.32 to 0.55), correlations between the value of the 1u-NA distance and the width of the coronal part of the central incisors and first molars, the length of the root part of the canines in the mesio-distal plane, the length of the root part of the central and lateral incisors and canines in the vestibulo-oral plane, the length of the central incisors and first premolars; medium-strength direct, mostly unreliable correlations (r= from 0.33 to 0.46) between the Pog-NB distance and the width of the coronal part of the lateral incisors, second premolars and first molars, the width of the coronal part of the first and second premolars, the length of the coronal part of the canines in the vestibulo-oral plane, the length of the first and second premolars; medium strength, mostly unreliable, direct (r= from 0.30 to 0.46) and inverse (r= from -0.30 to -0.37) correlations between the magnitude of the SNA angle and the width of the coronal part of the central incisors and canines in the mesio-distal plane, the width of the coronal part of the central incisors in the vestibulo-oral plane (direct), the length of the root part of the central and lateral incisors in the mesio-distal plane, the width of the coronal part of the first molars in the vestibulo-oral plane (inverse). *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the sizes of the lower jaw teeth in YM with a wide facial type revealed 63 relationships out of 560 possible (11.25 %), of which 0.19 % were reliable direct strong, 2.86 % were reliable direct medium-strength, 4.46 % were unreliable direct medium-strength, 1.25 % were reliable reverse medium-strength, and 2.50 % were unreliable reverse medium-strength.

As a result of the analysis of reliable and medium-strength unreliable relationships *between teleradiometric indicators according to the Steiner method with the sizes of dental arches in YM with a wide face type*, the following multiple correlations were found: mainly medium-strength unreliable, direct (r= from 0.32 to 0.64) and inverse (r= -0.31 and -0.34) between the value of the ANB angle and the value of the distances 13_23Bugr, DL_C, DL_F, DL_S, GL_1, GL_2 (direct), 33_43Bugr, 33_43Apx (inverse); medium strength, mainly direct reliable (r= from 0.39 to 0.46) and inverse unreliable (r= from -0.30 to -0.46), between the value of the angle Mand1-NB and the value of the distances DL_C, DL_F, DL_S,

GL_1 (direct), 33_43Bugr, 33_43Apx, dapx_46, mapx_46 (inverse); medium strength direct, mainly unreliable (r= from 0.34 to 0.53), between the value of the distance Pog-NB and the value of the distances 13_23Bugr, 33_43Bugr, mapex_6, mapx_46, PonPr and PonM. No reliable or medium-strength unreliable relationships were established with the sizes of dental arches in YM with a wide face type at all with the magnitude of the SNB, SN-OcP, SN-GoGn angles and the S-L distance according to the Steiner method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the sizes of dental arches in YM with a wide face type revealed 40 relationships out of 288 possible (13.89 %), of which 0.35 % were direct reliable strong, 3.82 % were direct reliable medium-strength, 5.56 % were direct unreliable medium-strength, 0.35 % were reverse reliable strong, 0.35 % were reverse reliable medium-strength, 3.47 % were reverse unreliable medium-strength.

As a result of the analysis of reliable and medium-strength unreliable relationships *between teleradiometric indicators according to the Steiner method with the sizes of the teeth of the upper jaw in YW with a wide facial type*, the following multiple correlations were found: medium-strength direct reliable and unreliable (r= from 0.31 to 0.50) correlations between the magnitude of the angles SNA, SNB, SND and the S-L distance and the width of the coronal and cervical parts of the central and lateral incisors in the mesio-distal plane, the width of the coronal part of the canines and first molars in the mesio-distal and vestibulo-oral planes, the length of the canines and the length of the root part of the canines in the mesio-distal and vestibulo-oral planes; as well as medium-strength inverse, mostly unreliable, and reliable (r= from -0.30 to -0.53) correlations between the magnitude of angle II and the length of the coronal part of the central incisors, the width of the coronal part of the first and second premolars in the mesio-distal plane, the width of the cervical part of the lateral incisors and canines, the width of the coronal part of the second premolars in the vestibulo-oral plane; between the size of the SN-OcP angle and the width of the coronal part of the central and lateral incisors, canines, second premolars and first molars, the width of the cervical part of the central and lateral incisors, the length of the coronal part of the central incisors in the mesio-distal plane, the length of the root part of the central and lateral incisors, the width of the cervical part of the lateral incisors, the width of the coronal part of the first molars in the vestibulo-oral plane; between the size of the S-E distance and the length of the root part of the lateral incisors and canines, the width of the coronal part of the first molars in the mesio-distal plane, the length of the coronal part of the central incisors, the length of the root part of the canines in the vestibulo-oral plane and the length of the canines, first and second premolars; as well as medium-strength, mostly unreliable, direct (r= from 0.30 to 0.42) and inverse (r= from -0.31 to -0.40) correlations between the value of the 1I-NB distance and the length of the coronal part of the central incisors, the length of the root part of the canines in the mesio-distal plane, the length of the root part of the central incisors and canines in the vestibulo-oral plane, the length of the first premolars (reverse), the length of the coronal part of the central incisors and canines, the width of the cervical part of the lateral incisors in the vestibulo-oral plane and the width of the coronal part of the first premolars in the mesio-distal plane (direct). No reliable or medium-strength unreliable relationships were established with the size of the upper jaw teeth in YW with a wide face type at all with the value of the 1u-NA distance according to the Steiner method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the size of the upper jaw teeth in YW with a wide face type revealed 105 relationships out of 560 possible (18.75 %), of which 4.64 % were reliable direct relationships of medium strength, 6.79 % were unreliable direct relationships of medium strength, 1.61 % were reliable inverse relationships of medium strength, and 5.71 % were unreliable inverse relationships of medium strength.

As a result of the analysis of reliable and medium-strength unreliable relationships between *teleradiometric indicators according to the Steiner method with the sizes of the lower jaw teeth in YW with a wide facial type*, the following multiple correlations were found: medium-strength direct reliable and unreliable (r= from 0.30 to 0.58) correlations between the magnitude of the SNB, SND angles and the S-L distance and the width of the coronal part of the central and lateral incisors, canines, second premolars and first molars, the length of the root part of the lateral incisors and canines in the mesiodistal plane, the width of the coronal, cervical part and the length of the root part of the canines, the width of the coronal part of the first molars in the vestibulo-oral plane, the length of the lateral incisors and canines; medium-strength direct reliable and unreliable (r= from 0.30 to 0.47) correlations between the magnitude of the SNA angle and the width of the coronal part of the central and lateral incisors, canines, second premolars and first molars in the mesio-distal plane and the width of the coronal part of the canines in the vestibulo-oral plane; medium-strength direct reliable and unreliable (r= from 0.31 to 0.49) correlations between the magnitude of the Max1-SN angle and the width of the coronal part of the lateral incisors, canines, second premolars and first molars in the mesio-distal plane, the width of the coronal and cervical part of the central incisors in the vestibulo-oral plane; medium-strength inverse, mostly significant (r= from -0.31 to -0.46), correlations between the size of the SN-OcP angle and the width of the coronal part of the central and lateral incisors, canines, second premolars and first molars, the length of the coronal part of the central incisors in the mesio-distal plane, the width of the coronal part of the lateral incisors and first molars in the vestibulo-oral plane; medium-strength inverse, mostly insignificant (r= from -0.30 to -0.40), correlations between the size of the ANB angle and the length of the root part of the central incisors and canines in the vestibulo-oral plane, the length of the

ISSN 1817-7883
eISSN 2522-9354

central and lateral incisors, canines and second premolars; medium-strength inverse, mostly unreliable (r= from -0.32 to -0.42), correlations between the size of the S-E distance and the width of the cervical part and the length of the root part of the central incisors in the mesio-distal plane, the length of the root part of the lateral incisors in the vestibulo-oral plane, the length of the lateral incisors, first and second premolars; medium-strength, mostly inverse unreliable (r= from -0.30 to -0.53), correlations between the size of the Mand1-NB angle and the 1l-NB distance and the length of the root part of the central incisors and canines in the vestibulo-oral plane, the length of the root part of the central incisors in the mesio-distal plane, the length of the central incisors, first and second premolars; medium-strength, mostly reliable, direct (r= from 0.36 to 0.54) and inverse (r= from -0.30 to -0.41) correlations between the value of the Pog-NB distance and the length of the coronal part of the central incisors and canines in the vestibulo-oral plane, the length of the root part of the central incisors in the mesio-distal plane, the length of the first and second premolars (direct), the length of the coronal part of the central and lateral incisors and canines in the mesio-distal plane, the length of the root part of the central incisors in the vestibulo-oral plane (inverse); There are medium-strength, mostly inverse (r= from -0.30 to -0.39), and direct (r= 0.32 and 0.34) correlations between the size of angle II and the width of the coronal part of canines, second premolars and first molars in the mesio-distal plane, the width of the coronal part of canines in the vestibulo-oral plane (inverse), the length of the root part of the central incisors in the mesio-distal plane and canines in the vestibulo-oral plane (direct). With the size of the teeth of the lower jaw in YW with a wide facial type, no reliable or medium-strength unreliable relationships were established with the value of the 1u-NA distance according to the Steiner method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the sizes of the lower jaw teeth in YW with a wide facial type revealed 105 relationships out of 560 possible (18.75 %), of which 4.11 % were reliable direct relationships of medium strength, 6.79 % were unreliable direct relationships of medium strength, 2.86 % were reliable inverse relationships of medium strength, and 5.00 % were unreliable inverse relationships of medium strength.

As a result of the analysis of reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Steiner method with the sizes of dental arches in YW with a wide face type*, the following multiple correlations were found: mainly medium-strength direct reliable (r= from 0.30 to 0.62), between the magnitude of the SNB, SND angles and the S-L distance and the magnitude of the distances 13_23Bugr, 13_23Apx, mapex_6, dapx_6, VestBM, dapx_46, mapx_46, PonPr, PonM, DL_C and GL_1; medium strength, mainly direct unreliable correlations (r= from 0.32 to 0.43), between the value of the angle SNA and the value of the distances 13_23Bugr, 33_43Bugr, mapex_6, dapx_6, mapx_46, PonPr, DL_C, DL_S and GL_1; mainly medium strength direct reliable correlations (r= from 0.31 to 0.65), between the value of the angle Max1-SN and the value of the distances 33_43Bugr, dapx_46, mapx_46, DL_C, DL_F and DL_S; inverse, mostly of medium strength, unreliable (r= from -0.30 to -0.40) and reliable (r= from -0.48 to -0.63) between the SN-OcP angle and the distances 13_23Bugr, 13_23Apx, napx_6, dapx_6, VestBM, 33_43Bugr, dapx_46, mapx_46, PonM, DL_C, DL_F, DL_S, GL_1 and GL_3. With the sizes of dental arches in YW with a wide face type, no reliable or moderately unreliable relationships were established, only with the distance 1u-NA according to the Steiner method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Steiner method with the dimensions of dental arches in YW with a wide facial type revealed 96 relationships out of 288 possible (33.33 %), of which 0.69 % were direct reliable strong, 10.76 % were direct reliable medium-strength, 10.42 % were direct unreliable medium-strength, 0.35 % were reverse reliable strong, 4.86 % were reverse reliable medium-strength, and 6.25 % were reverse unreliable medium-strength.

The results of the study demonstrate the presence of pronounced relationships between teleradiometric indicators according to the Steiner method, tooth sizes, dental arch parameters and morphological characteristics of the face in Ukrainian boys and girls with physiological occlusion and a wide face type. These relationships allow us to clarify the mechanisms of harmonious development of the maxillofacial region and determine the features of normal anatomical variability. According to N. O. Brotskyi et al. (2025) in patients with physiological occlusion, a statistically significant relationship is observed between the angular indicators of teleradiograms (in particular, ANB, SNB) and the width of the dental arches in the frontal and lateral directions (r=0.62-0.71; p<0.05), which confirms the functional dependence between the spatial position of the jaws and the shape of the dentition [5].

The assessment of correlations between the sizes of individual teeth and maxillofacial parameters deserves special attention. The width of the incisors, premolars and molars is significantly related to the size of the jaws and the length of the facial skeleton, with these figures being on average 6-9 % larger in men than in women [1]. This is consistent with our data, which demonstrate differences in teleradiometric indicators by sex even within the same morphogroup – individuals with a wide face type. The results of the V. O. Orlovskiy (2017) study indicate that the size of the premolars has a positive correlation with linear cephalometric parameters (for example, the length of the skull base and the height of the lower jaw), which indicates a general interdependence in the structure of the skull and the dentofacial system [16].

The analysis of the relationship between the width of the dental arches and the functional characteristics of the organism also attracts attention. Narrow arch shape is associated with an increased risk of obstructive sleep apnea (OSA), while wider dental arches correlate with lower severity of OSA (p<0.05), confirming the importance of morphometry

in systemic physiology [8]. Similar findings were made by Y. H. Lee et al. (2020) where preschool children with mild apnea had shorter dental arches and reduced mandibular dimensions [12]. These findings suggest the potential impact of dentition features not only on aesthetics but also on functional aspects of breathing and speech.

Another important aspect is the relationship between the number of teeth and facial dimensions. According to E. S. Oeschger et al. (2020) the presence of a full set of permanent teeth is associated with greater facial length, especially in the sagittal direction, while the loss of one or more teeth leads to a decrease in facial width and height ($p<0.01$) [14]. Given this trend, it can be assumed that the harmonious development of the dental arch maintains the stability of facial dimensions, which is especially important for individuals with a wide face type, where the ratio between the width and length of the facial skeleton is of key importance for assessing the norm.

The width of the dental arch is closely related to the coronal parameters of the anterior teeth, especially their width and height (correlation coefficient r=0.68-0.74), which is relevant for building individualized orthodontic models [19]. In the context of our study, these data indicate the need to take into account the morphometric characteristics of the anterior teeth when analyzing and predicting the dimensions of the arches and the relationships between them. As shown by N. P. Oreški et al. (2017) the aesthetic perception of teeth depends not only on their shape, but also on the proportions between the elements of the face, which emphasizes the importance of a comprehensive approach to planning orthodontic treatment [15].

These findings are also consistent with the results of the study by K. Zhang et al. (2016), where it was found that the width of the upper jaw directly affects the attractiveness of the smile ($p<0.001$), and the narrowing of the jaw leads to a decrease in the width of the smile and an increase in the visual deficit of space, which is especially critical in people with a wide face [23]. At the same time, B. Shi and J. E. Losee (2015) in their study indicate that the violation of the integrity of the jaw structure (as in clefts) seriously changes the parameters of jaw growth and facial proportions even after surgical correction, which indicates the complexity of the relationships between genetic, morphological and functional factors [20].

Thus, the results of our study confirm that the morphological structure of the face, in particular its width, significantly affects the formation of the dimensions of the dental arches and teeth, as well as the indicators of teleradiometric analysis. The identified relationships are an important basis for constructing normative indicators of orthodontic examination that take into account the individual characteristics of the anthropotype. Further research involving artificial intelligence and three-dimensional visualization methods can significantly expand the possibilities of personalized orthodontics, taking into account aesthetic, anatomical, and functional parameters.

Conclusions and prospects for further development

1. In Ukrainian YM and YW with physiological bite and wide facial type, multiple reliable and medium-strength unreliable connections of teleradiometric indicators according to the Steiner method with the sizes of teeth of the upper (respectively, in YM 10.00 % of the total number, including 7.86 % straight; in YW 18.75 % of the total number, including 11.43 % straight), lower (respectively, in YM 11.25 % of the total number, including 7.51 % straight; in YW 18.75 % of the total number, including 10.90 % straight) jaws and the sizes of dental arches (respectively, in YM 13.89 % of the total number, including 9.73 % straight; in YW 33.33 % of the total number, including 21.87 % straight) jaws were established.

2. Pronounced manifestations of sexual dimorphism of the relationships between teleradiometric indicators according to the Steiner method and computed tomography dimensions of the teeth of the upper and lower jaws and dental arches in Ukrainian YM and YW with a physiological bite and a wide facial type have been established.

In further studies, it is planned to study the features and sexual differences of the correlations between teleradiometric indicators according to the Tweed method and computed tomography dimensions of the teeth and dental arches in Ukrainian YM and YW with a physiological bite and different facial types.

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ОСОБЛИВОСТІ ЗВ'ЯЗКІВ ТЕЛЕРЕНТГЕНОМЕТРИЧНИХ ПОКАЗНИКІВ ЗА МЕТОДОМ STEINER ІЗ РОЗМІРАМИ ЗУБІВ І ЗУБНИХ ДУГ В УКРАЇНСЬКИХ ЮНАКІВ І ДІВЧАТ ІЗ ФІЗІОЛОГІЧНИМ ПРИКУСОМ ІЗ ШИРОКИМ ТИПОМ ОБЛИЧЧЯ

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Анотація. *Вивчення особливостей краніофаціального розвитку в осіб із різними типами обличчя має важливе значення для оптимізації ортодонтичного планування. Телерентгенографічні показники за методом Steiner дозволяють оцінити просторові взаємозв'язки щелеп, зубів і м'яких тканин профілю. Актуальним є аналіз кореляцій між цефалометричними характеристиками, розмірами зубів та параметрами зубних дуг у пацієнтів із гармонійним оклюзійним розвитком. Це дає змогу краще зрозуміти анатомо-функціональні закономірності щелепно-лицевої області в підлітковому віці. Мета дослідження – встановлення особливостей зв'язків між телерентгенометричними показниками за методом Steiner із розмірами зубів і зубних дуг в українських юнаків і дівчат із фізіологічним прикусом із широким типом обличчя. Проведено морфометричне дослідження комп'ютерно-томографічних розмірів зубів, зубних дуг і визначені телерентгенометричні показники за методом Steiner первинних комп'ютерних томограм 25 українських юнаків і 25 українських дівчат із фізіологічним прикусом із широким типом обличчя за Гарсоном, що були отримані з банку даних кафедри стоматології дитячого віку та науково-дослідного центру Вінницького національного медичного університету ім. М. І. Пирогова. Оцінка кореляцій між телерентгенометричними показниками за методом Steiner і комп'ютерно-томографічними розмірами зубів і зубних дуг проведена у ліцензійному пакеті «Statistica 6.0» за допомогою непараметричної статистики Спірмена. В результаті аналізу достовірних і середньої сили недостовірних кореляцій між телерентгенометричними показниками за методом Steiner із розмірами зубів і зубних дуг в юнаків і дівчат із широким типом обличчя встановлено: в юнаків – 10,00 % подібних зв'язків із розмірами зубів верхньої щелепи (переважно недостовірних прямих середньої сили), 11,25 % із розмірами зубів нижньої щелепи (переважно достовірних і недостовірних прямих середньої сили) та 13,89 % із розмірами зубних дуг (переважно достовірних і недостовірних прямих середньої сили); у дівчат – 18,75 % подібних зв'язків із розмірами зубів верхньої щелепи (переважно достовірних і недостовірних прямих та недостовірних*

зворотних середньої сили), 18,75 % із розмірами зубів нижньої щелепи (переважно достовірних і недостовірних прямих та недостовірних зворотних середньої сили) та 33,33 % із розмірами зубних дуг (достовірних і недостовірних прямих і зворотних, переважно середньої сили). Таким чином, в українських юнаків і дівчат із фізіологічним прикусом із широким типом обличчя встановлені особливості та статеві відмінності зв'язків між телерентгенометричними показниками за методом Steiner та комп'ютерно-томографічними розмірами зубів і зубних дуг.

Ключові слова: *стоматологія, телерентгенометрія за методом Steiner, конусно-променева комп'ютерна томографія, зуби, зубні дуги, українські юнаки та дівчата, широкий тип обличчя, фізіологічний прикус, кореляції, статевий диморфізм.*