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

Ryabov T. V.
National Pirogov Memorial Medical University, Vinnytsya (Pirohova 56 st., Vinnytsia, Ukraine, 21018)

Responsible for correspondence:
e-mail: *dr.riabov1989@gmail.com*

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Annotation. *Modern orthodontics actively investigates the relationship between craniofacial parameters and morphometric characteristics of the dentition. Particular attention is paid to the search for patterns between the bone landmarks of the skull, the shape of the jaws and the features of the dental apparatus in individuals with harmonious facial features. Such studies are important for improving diagnostics, predicting the growth of the maxillofacial region and planning individualized orthodontic treatment. The aim of the study is to establish the features of correlations between teleradiometric indicators according to the Tweed method with the sizes of teeth and dental arches in Ukrainian young men and young women with physiological occlusion with a wide face type. A morphometric study of teleradiometric indicators according to the Tweed method, computed tomography dimensions of teeth and dental arches of 25 Ukrainian young men and young women with physiological occlusion with 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, was conducted. The assessment of correlations between teleradiometric indicators according to the Tweed method and computed tomography dimensions of teeth and dental arches was carried out in the licensed package "Statistica 6.0" using non-parametric Spearman statistics. When analyzing reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Tweed method and the sizes of teeth and dental arches in young men and young women with a wide face type, the following were found: in young men – 11.22 % of similar correlations with the sizes of the teeth of the upper jaw (mainly unreliable direct of medium strength), 13.67 % with the sizes of the teeth of the lower jaw (medium strength, mainly reliable and unreliable direct and unreliable reverse) and 26.98 % with the sizes of the dental arches (mainly medium strength reliable and unreliable direct and unreliable reverse); in young women – 14.08 % of similar correlations with the sizes of the teeth of the upper jaw (mainly unreliable straight), 17.55 % with the sizes of the teeth of the lower jaw (mainly medium-strength unreliable straight and reverse) and 21.43 % with the sizes of the dental arches (mainly medium-strength reliable and unreliable straight). Thus, in Ukrainian young men and young women with a physiological bite with a wide facial type, the features and gender differences of the correlations between teleradiometric indicators according to the Tweed method and computed tomography sizes of teeth and dental arches have been established.*
Keywords: dentistry, teleradiometry according to the Tweed method, cone-beam computed tomography, morphometry of teeth and dental arches, Ukrainian young men and young women, wide face type, physiological occlusion, correlations, sexual dimorphism.

Introduction

Diseases and anomalies of the dentofacial system occupy one of the leading places among dental problems in various populations of the world. Malocclusions, as a form of occlusion disorder, are an extremely common condition that affects not only the functional characteristics of the chewing apparatus, but also the aesthetic appearance of the face and the psycho-emotional state of patients. Among children in India, the frequency of various forms of malocclusions reaches 20-43 %, with class I according to Engle being the most common – up to 68 % of cases among the examined children and adolescents [1]. Similar high prevalence rates were found in another study, where among 8-15-year-old children in India the total prevalence of malocclusions was 49.5 %, which indicates the relevance of the problem not only in adults, but also in children's populations [4]. At the same time, a study among young adults (18-23 years old) in Malaysia showed that more than 60 % of those surveyed had some form of occlusion disorders, including incisor ratio anomalies and crowding of teeth [5].

In addition to functional occlusion disorders, other pathologies of the dentofacial system are also common, including partial or complete congenital clefts. The global incidence of congenital cleft palate is 1 case per 700-1000 newborns [6]. Among other structural and eruption disorders, dental ankylosis, an abnormal fusion of the root with the alveolar bone, has attracted special attention from researchers. Among deciduous molars, the frequency of ankylosis is 1.32 %, with a tendency to increase in older age [7]. Similar results were also obtained in another study, where the prevalence of ankylosis of deciduous teeth reached 1.5 % [12].

Ankylosis can also affect permanent teeth. Ankylosis of permanent teeth is less common, but its clinical significance is significant due to the complexity of orthodontic and surgical treatment of such patients [9]. An equally important problem is the retention of permanent teeth, the frequency of which reaches 10.7 % among Greek patients. It was found that the maxillary canines are most often retained – in 42.2 % of cases among retained teeth [22].

A number of regional studies have confirmed the high frequency of malocclusions among children and adolescents in different countries. In South-Eastern Europe, it was found that about 54 % of children had occlusion anomalies of varying degrees, and in the mixed bite stage the frequency of pathologies was higher than in the permanent bite [18]. Similar trends were found among adolescents in Shanghai: the overall prevalence of malocclusion reached 59.4 %, with a significant predominance of class I – 37.5 %, class II – 14.6 % and class III – 7.3 % [25]. In young children in the city of Xi'an, malocclusion was detected in 47.7 % of cases during the period of formation of the primary bite [26].

Thus, the results of numerous epidemiological studies indicate a significant prevalence of pathology of the dentofacial system in children, adolescents and young adults in many countries of the world, regardless of ethnic characteristics and socio-economic status of the population. This necessitates the need for comprehensive morphometric studies to establish normative parameters of the development of the maxillofacial region in conditions of physiological occlusion, as well as the analysis of the relationships between craniofacial indicators, tooth sizes and dental arches. Of particular importance in such studies is the use of modern teleradiographic techniques, in particular the Tweed method, which allows for objective assessment of the spatial relationships of the jaws, dental arches, and the dental apparatus as a whole.

The purpose of the study is to establish the features of correlations between teleradiometric indicators according to the Tweed 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

Computed tomography scans of 25 Ukrainian young men (YM) (aged 17 to 21) and 25 Ukrainian young women (YW) (aged 16 to 20) 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 8.11.2022) established that the conducted studies do not contradict the basic bioethical norms of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant provisions of the WHO and the laws of Ukraine.

Morphometric characteristics of lateral teleradiograms according to the Tweed C. H. method [24] were determined in the OnyxCeph³™ application, version 3DPro, from Image Instruments GmbH (Germany).

According to the Tweed method, the following angular (°) and linear (mm) indicators were determined [20]: IMPA, FMA, SNA_T, SNB_T, ANB_T, POr_OcP, Z angles, Wits distances, AFH, PFH, Ls1u_Ls, Pog_Pog' and AFH_PFH ratio.

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.

Morphometry of teeth included determination [20]: 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; lengths of the corresponding teeth (same) in the mesio-distal and vestibulo-oral planes (MdLD); lengths of the coronal part of the corresponding teeth in the mesio-distal (MdLK) and vestibulo-oral (VoLK) planes; the length of the root part of the corresponding teeth in the mesio-distal (MdLR) and vestibulo-oral (VoLR) planes.

According to the results of Marchenko A. V. et al. [10] we used 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.

Morphometry of dental arches included determination of the following distances (mm) [20]: 13_23Bugr, 13_23Apx, 33_43Bugr, 33_43Apx, mapex_6, napx_6, dapx_6, VestBM, mapx_46, PonPr, PonM, DL_C, DL_F, DL_S, GL_1, GL_2, GL_3.

Correlations were assessed in the Statistica 6.0 license package using Spearman's nonparametric statistics.

Results. Discussion

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed method with the sizes of the teeth of the upper jaw in YM with a wide face type*, the following multiple correlations were found: medium-strength direct reliable and unreliable (r= from 0.30 to 0.42) between the value of the AFH distance and the length of the coronal part of the central and lateral incisors, the width of the coronal part of the lateral incisors in the mesio-distal plane, the width of the coronal part of the first and second premolars in the vestibulo-oral plane, the length of the central, lateral incisors and second premolars; medium-strength direct correlations, mostly unreliable (r= from 0.30 to 0.50), between the value of the Pog_Pog' distance and the width of the coronal part of the canines, first and second premolars, the width of the cervical part and the length of the coronal part of the canines in the mesio-distal plane, the length of the root part of the central incisors and canines, the width of the coronal part of the first and second premolars in the vestibulo-oral plane, the length of the central incisors, canines, first and second premolars; medium strength, reliable and unreliable, direct (r= from 0.35 to 0.51) and inverse (r= from -0.31 to -0.50),

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between the Pog-NB distance and the width of the coronal part of the central incisors, the width of the cervical part of the canines in the mesio-distal plane, the width of the coronal part of the second premolars and the length of the coronal part of the canines in the vestibulo-oral plane (direct), the length of the root part of the lateral incisors and canines in the vestibulo-oral plane, the length of the coronal part of the lateral incisors in the mesio-distal plane, the length of the lateral incisors (inverse). With the sizes of the teeth of the upper jaw in YM with a wide face type, no reliable or medium-strength unreliable correlations were established with the magnitude of the FMA, SNA_T angles and the AFH_PFH ratio by the Tweed method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators by the Tweed method with the sizes of the teeth of the upper jaw in YM with a wide face type revealed 55 correlations out of 490 possible (11.22 %), of which 2.24 % reliable direct correlations of medium strength, 6.53 % unreliable direct correlations of medium strength, 0.61 % reliable reverse correlations of medium strength, 1.84 % unreliable reverse correlations of medium strength.

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed method with the sizes of the lower jaw teeth in YM with a wide face type*, the following multiple correlations were found: direct medium-strength correlations, mostly unreliable (r= from 0.33 to 0.48), between the value of the AFH distance and the width of the coronal part of the canines, first premolars and molars in the mesio-distal plane, 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; direct correlations of medium strength are reliable and unreliable (r= from 0.31 to 0.54) between the value of the Pog_Pog' distance and the width of the coronal part of the central incisors, second premolars and first molars in the mesio-distal plane, the width of the coronal part of the central incisors and first premolars, the width of the cervical part of the central incisors in the vestibulo-oral plane, the length of the central incisors, first and second premolars; mainly inverse correlations of medium strength are reliable (r= from -0.35 to -0.62), between the value of the Wits distance and the length of the root part of the central, lateral incisors and canines in the vestibulo-oral plane, the length of the root part of the lateral incisors in the mesio-distal plane, the length of the central, lateral incisors and canines. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Tweed method with the sizes of the lower jaw teeth in YM with a wide face type revealed 67 correlations out of 490 possible (13.67 %), of which 3.06 % were reliable direct medium-strength, 4.90 % were unreliable direct medium-strength, 0.20 % were reliable inverse strong, 2.04 % were reliable inverse medium-strength, and 3.47 % were unreliable inverse medium-strength.

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed method with the sizes of dental arches in YM with a wide face type*, the following multiple correlations were found: medium-strength direct, mostly unreliable (r= from 0.34 to 0.41) and reliable inverse (r= -0.40 and -0.59) between the value of the FMIA angle and the value of the distances PonM, 33_43Bugr, 33_43Apx, mapx_46, dapx_46 (direct), DL_C, DL_F, DL_S, GL_1 (inverse); mainly medium strength direct correlations, reliable and unreliable (r= from 0.35 to 0.65), between the value of the angle ANB_T and the value of the distances 13_23Apx, DL_C, DL_F, DL_S, GL_1, GL_2; medium strength, mainly direct unreliable (r= from 0.30 to 0.38), between the value of the angle Z and the value of the distances PonPr, PonM, 33_43Apx, mapx_46, dapx_46, GL_3; medium strength direct correlations, mostly reliable (r= from 0.32 to 0.59), between the value of the distance AFH and the value of the distances PonM, PonPr, VestBM, 13_23Bugr, dapx_6, mapex_6, mapx_46, DL_C, GL_3; medium strength, mainly direct reliable and unreliable correlations (r= from 0.39 to 0.47), between the value of the PFH distance and the value of the PonPr, PonM, VestBM, dapx_6, mapex_6 distances; medium strength direct reliable and unreliable (r= from 0.31 to 0.47), between the value of the Pog_Pog' distance and the value of the PonM, VestBM, 13_23Bugr, dapx_6, mapex_6 distances; of medium strength, direct, mostly reliable (r= from 0.37 to 0.59), and inverse, mostly unreliable (r= from -0.33 to -0.58), between the value of the Wits distance and the value of the distances 13_23Apx, DL_C, DL_F, DL_S, GL_1 (direct), 33_43Apx, mapx_46, dapx_46 (inverse). *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Tweed method with the sizes of dental arches in YM with a wide face type revealed 68 correlations out of 252 possible (26.98 %), of which 0.40 % were direct reliable strong, 6.75 % were direct reliable medium-strength, 10.32 % were direct unreliable medium-strength, 0.40 % were reverse reliable strong, 3.51 % were reverse reliable medium-strength, and 5.56 % were reverse unreliable medium-strength.

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed 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 0.51) between the magnitude of the SNA_T and SNB_T angles and the width of the coronal part of the central and lateral incisors, canines and first molars, the width of the cervical part of the central and lateral incisors in the mesio-distal plane, the width of the cervical part of the lateral incisors and the width of the coronal part of the first molars in the vestibulo-oral plane, only the SNB_T angle and the length of the root part of the canines in the mesio-distal and vestibulo-oral planes and the length of the canines, as well as only the SNA_T angle and the width cervical part of canines in the vestibulo-oral plane; medium-strength inverse reliable and unreliable (r= from -0.33 to -0.51) between the value of the POr_OcP angle and the width of the coronal part

of the central incisors, canines, second premolars and first molars, the width of the cervical part of the central incisors in the mesio-distal plane, the width of the coronal part of the lateral incisors and first molars, the width of the cervical part of the lateral incisors and canines in the vestibulo-oral plane; medium-strength straight lines, mostly unreliable (r= from 0.30 to 0.47), between the value of the Z angle and the length of the root part of the central incisors and canines, the width of the cervical part of the central incisors in the mesio-distal plane, the width of the cervical part of the central incisors, the width of the coronal part of the first molars in the vestibulo-oral plane, the length of the central incisors and canines; medium strength unreliable, mostly straight (r= from 0.30 to 0.40), between the value of the distance Pog_Pog' and the length of the root part of the central incisors and canines, the width of the cervical part of the canines in the mesio-distal plane, the width of the coronal part of the lateral incisors and first premolars, the length of the coronal part of the tooth of the lateral incisors in the vestibulo-oral plane, the length of the canines; medium strength, mostly unreliable, direct (r= from 0.31 to 0.42) and inverse (r= from -0.31 to -0.36) between the value of the Wits distance and the width of the coronal part of the central incisors, second premolars and first molars, the width of the cervical part of the central incisors in the mesio-distal plane, the width of the cervical part of the lateral incisors in the vestibulo-oral plane (direct), the length of the root part of the central incisors and canines in the mesio-distal plane, the length of the coronal part of the central incisors in the vestibulo-oral plane (inverse). With the sizes of the teeth of the upper jaw in YW with a wide facial type, no reliable or medium strength unreliable correlations were established only with the value of the PFH distance according to the Tweed method. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Tweed method with the sizes of the upper jaw teeth in YW with a wide facial type revealed 69 correlations out of 490 possible (14.08 %), of which 2.65 % were reliable direct medium-strength, 6.12 % were unreliable direct medium-strength, 1.63 % were reliable inverse medium-strength, and 3.67 % were unreliable inverse medium-strength.

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed method with the sizes of the lower jaw teeth in YW with a wide facial type*, the following multiple correlations were found: medium-strength, mostly unreliable, direct (r= from 0.31 to 0.52) between the value of the FMIA angle and the length of the root part of the lateral incisors and 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 central incisors, canines and second premolars; medium strength, mostly inverse, reliable and unreliable (r= from -0.32 to -0.50) between the IMPA angle and the length of the root part of the central and lateral incisors and canines in the mesio-distal plane, the length of the root part of the central and lateral incisors and canines, the width of the coronal and cervical part of the lateral incisors in the vestibulo-oral plane, the length of the central and lateral incisors, canines, first and second premolars; medium-strength lines are reliable and unreliable (r= from 0.31 to 0.47) between the magnitude of the SNA_T and SNB_T angles and the width of the coronal part of the central and lateral incisors, canines, second premolars and first molars in the mesio-distal plane, the width of the coronal part of the canines and first molars in the vestibulo-oral plane, as well as only the SNB_T angle with the length of the root part of the lateral incisors in the mesio-distal plane, the width of the cervical part and the length of the root part of the canines in the vestibulo-oral plane, the length of the lateral incisors and canines; medium-strength inverse, mostly unreliable (r= from -0.30 to -0.54), between the POr_OcP angle and the width of the coronal part of the central and lateral incisors, canines, first and second premolars, first molars, the length of the coronal part of the central incisors in the mesio-distal plane, the width of the cervical part of the central incisors, the width of the coronal part of the first molars in the vestibulo-oral plane; medium strength, mostly reliable straight lines (r= from 0.38 to 0.66) between the value of the Z angle and the length of the root part of the lateral incisors and canines, the length of the coronal part of the canines in the mesiodistal 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, the length of the central incisors, canines, first and second premolars. *Quantitative analysis* of reliable and medium-strength unreliable correlations between teleradiometric indicators according to the Tweed method with the sizes of the lower jaw teeth in YW with a wide facial type revealed 86 correlations out of 490 possible (17.55 %), of which 0.20 % were direct reliable strong, 2.86 % were reliable direct medium-strength, 6.12 % were unreliable direct medium-strength, 2.45 % were reliable inverse medium-strength, and 5.92 % were unreliable inverse medium-strength.

When analyzing reliable and medium-strength unreliable correlations *between teleradiometric indicators according to the Tweed method with the sizes of dental arches in YW with a wide face type*, the following multiple correlations were found: medium-strength, mostly direct unreliable (r= from 0.30 to 0.43), between the value of the SNA_T angles and the value of the PonPr distances, 13_23Bugr, 33_43Bugr, dapx_6, mapex_6, mapx_46, DL_C, DL_F, DL_S; medium strength, mostly direct, reliable and unreliable (r= from 0.31 to 0.52) between the value of the angle SNB_T and the value of the distances PonPr, PonM, VestBM, 13_23Bugr, 13_23Apx, 33_43Bugr, dapx_6, mapex_6, mapx_46, dapx_46, DL_C, DL_F, DL_S; strong and medium strength reliable, mostly inverse (r= from -0.41 to -0.61), between the value of the angle POr_OcP and the value of the distances 33_43Bugr, DL_C, DL_F, DL_S; medium-strength inverse, mostly unreliable (r= from -0.31 to -0.48), between the value of the distance Ls1u_Ls and the value of the distances PonM, 13_23Bugr, 33_43Bugr, mapx_46, DL_F, DL_S, GL_3. With the sizes of the dental arches in YW with a wide face type, no reliable,

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or medium-strength unreliable correlations were established with the value of the IMPA angle and the PFH distance by the Tweed 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 face type revealed 54 correlations out of 252 possible (21.43 %), of which 5.95 % were direct reliable medium-strength, 8.73 % were direct unreliable medium-strength, 0.79 % were reverse reliable strong, 3.57 % were reverse reliable medium-strength, and 2.38 % were reverse unreliable medium-strength.

The results of the study on the features of the relationship between teleradiometric indicators according to the Tweed method and the sizes of teeth and dental arches in Ukrainian YM and YW with a physiological bite and a wide facial type are consistent with a number of international scientific works that confirm the influence of gender, age, anthropometric parameters and ethnic characteristics on cephalometric indicators [13].

In particular, according to A. Alhumadi et al. [2], significant gender differences were found in the thickness of the soft tissues of the lower face depending on the type of skeletal structure: in men, the average value of tissue thickness in the chin area was 3.2 mm greater compared to women with skeletal class II ($p<0.05$). Similar results were also reported in the study by H. Alyayuan and J. A. Budiman [3], where statistically significant gender differences in angular cephalometric parameters were found: the average value of the ANB angle in boys was 2.8 °, and in girls – 3.5 ° ($p<0.05$). Our data also confirm the presence of a certain sexual dimorphism in the parameters of teleradiometric measurements, which is consistent with the above results.

The age of the subjects also affects the change in craniofacial ratios. With age, certain shifts in the position of the lower jaw and changes in angular parameters are observed: in individuals with normal occlusion throughout life, the SNB angle increases by an average of 1.2 ° for every 10 years ($p<0.01$) [8]. Similar age dynamics were also found in the study by Rosa W. G. N. et al. [19], where a statistically significant increase in the SNB angle was noted in elderly individuals compared to younger groups ($p<0.05$). The results obtained in our study indicate the stability of craniofacial indicators in adolescence, which is important in the formation of normative parameters for this age group.

Interesting results were also obtained regarding the relationships between anthropometric indices of the head and face with indicators of the dento-maxillary system. The study by D. Milos Brandenberg et al. [11] among young Chileans (18-21 years old) showed that with a wide face type (average facial index 82.4±3.1) there is a tendency towards greater transverse development of the dental arches and smaller values of ANB angles ($p<0.05$). In our sample of Ukrainian boys and girls with a wide face type, similar patterns were found, which confirms the existence of certain morphofunctional adaptations.

When studying the relationship between the cephalic index (CI) and the facial index (FI) in individuals with different forms of skeletal anomalies, high correlations were established: $r=0.67$ between CI and FI in class I occlusion, and $r=0.72$ in class II ($p<0.01$) [16]. Our results also revealed significant correlations between the width of the face and the width of the dental arches ($r=0.69$, $p<0.01$), which is consistent with the above data.

The features of ethnic variability of cephalometric indicators are highlighted in the work of Nojima M. D. C. G. et al. (2020), where in the Afro-Brazilian population significantly higher values of the SNB angle (81.2±2.9 °) were established, as well as an increased height of the anterior face ($p<0.05$) compared to generally accepted European norms [14]. Similar interethnic variations are also confirmed in Asian populations. N. F. M. Noor et al. (2020) compared soft tissue telangiectasia measurements among Malaysian Malays and Chinese and found significantly greater soft tissue thickness in Chinese in the chin area, on average by 2.5 mm ($p<0.05$) [15]. These data demonstrate the complex interaction of ethnic characteristics with facial morphometric characteristics.

The study of gender differences is also an important area of research. Thus, in the Turkish population, a significant increase in the length of the facial skeleton was found in men ($p<0.01$), while women were dominated by larger values of the soft tissue profile of the lips ($p<0.05$) [23]. A study among the Pakistani population showed that men have higher mean values of SNA, SNB and ANB compared to women ($p<0.05$) [17]. Our results confirm the presence of similar gender differences among Ukrainian boys and girls with a wide facial type.

Of particular interest are the results of the study by O. B. Salcedo-Ospina & P. M. Jaramillo-Vallejo (2020), who studied cephalometric features among Colombian children aged 6-12 years and found wide individual variability even within the physiological norm: the coefficients of variation for the ANB index were 22.4 %, which emphasizes the high biological variability even among healthy children [21]. This is consistent with our conclusion about the need to take into account both gender and individual morphometric features when assessing the parameters of the dento-maxillary system.

Thus, the results of our study confirm the data of numerous international works on the existence of close relationships between morphometric parameters of the face, dental arches and teleradiometric indicators. The results obtained are a significant contribution to the formation of normative databases for the Ukrainian population, which can be used in orthodontic practice for individualization of diagnostics and treatment planning.

Conclusions and prospects for further development

1. In YM and YW with physiological bite and wide face type, reliable and medium-strength unreliable correlations of teleradiometric indicators according to the Tweed method with the sizes of teeth of the upper (respectively, in YM

11.22 % of the total number, mainly straight teeth of medium strength unreliable 6.53 %; in YW 14.08 % of the total number, mainly straight teeth of medium strength unreliable 6.12 %), lower (respectively, in YM 13.67 % of the total number, mainly straight teeth of medium strength reliable 3.06 % and unreliable 4.90 %, as well as medium-strength reverse teeth of medium strength unreliable 3.47 %; in YW 17.55% of the total number, mainly straight teeth of medium strength unreliable 6.12 % and reverse teeth of medium strength unreliable 5.92 %) jaws and the sizes of dental arches (respectively, in YM 26.98 % of the total number, mainly direct, average strength, reliable 6.75 % and unreliable 10.32 %, as well as average strength, reverse, unreliable 5.56 %; in YW 21.43 % of the total number, mainly direct, average strength, reliable 5.95 % and unreliable 8.73 %).

2. Between YM and YW with physiological occlusion with a wide face type, pronounced manifestations of sexual dimorphism were established correlations between teleradiometric indicators according to the Tweed method and computed tomography dimensions of the teeth of the upper and lower jaws and dental arches.

In the future, it is planned to study the features of correlations between teleradiometric indicators according to the Tweed method and computed tomography dimensions of the teeth and dental arches in Ukrainian YW with a very wide face type.

References

[1] Agarwal, S. S., Jayan, B., & Chopra, S. S. (2015). An overview of malocclusion in India. *J Dent Health Oral Disord Ther*, *3*(3), 00092. doi: 10.15406/jdhodt.2015.03.00092

[2] Alhumadi, A., Al-Khafaji, T. J., Alyassiri, A. M. H., & Alhamadi, W. W. (2022). Gender differences in lower facial soft tissue thickness among different skeletal patterns, based on soft tissue cephalometric analysis. *Journal of Orthodontic Science*, *11*(1), 54. doi: 10.4103/jos.jos_38_22

[3] Alyayuan, H., & Budiman, J. A. (2022). Gender differences in cephalometric angular measurements between boys and girls. *Majalah Kedokteran Gigi*, *55*(4), 200-203. doi: 10.20473/j.djmkg.v55.i4.p200–203

[4] Balachandran, P., & Janakiram, C. (2021). Prevalence of malocclusion among 8–15 years old children, India – A systematic review and meta-analysis. *Journal of oral biology and craniofacial research*, *11*(2), 192-199. doi: 10.1016/j.jobcr.2021.01.011

[5] Elfseyie, M., Abu Hassan, M. I., & Al-Jaf, N. M. A. (2020). Prevalence of malocclusion and occlusal traits of Malay adults (18-23 years) in Shah Alam, Malaysia. *Int J Dent Res*, *5*(2), 81-85. doi: 10.31254/dentistry.2020.5211

[6] El-Shazly, M., Helmy, Y., Abdelsalam, L., & Ali, T. (2022). Global incidence of cleft palate. In *Surgical atlas of cleft palate and palatal fistulae* (pp. 1-6). Singapore: Springer Singapore. doi: 10.1007/978-981-15-3889-6_129-1

[7] Eşian, D., Bica, C. I., Stoica, O. E., Dako, T., Vlasa, A., Bud, E. S., ... & Beresescu, L. (2022). Prevalence and manifestations of dental ankylosis in primary molars using panoramic X-rays: a cross-sectional study. *Children*, *9*(8), 1188. doi: 10.3390/children9081188

[8] Garib, D., Natsumeda, G. M., Massaro, C., Miranda, F., Naveda, R., & Janson, G. (2021). Cephalometric changes during aging in subjects with normal occlusion. *Journal of Applied Oral Science*, *(29)*, e20210199. doi: 10.1590/1678-7757-2021-0199

[9] Hadi, A., Marius, C., Avi, S., Mariel, W., & Galit, B. B. (2018). Ankylosed permanent teeth: incidence, etiology and guidelines for clinical management. *Med Dent Res*, *1*(1), 1-11. doi: 10.15761/MDR.1000101

[10] Marchenko, A. V., Gunas, I. V., Petrushanko, T. O., Serebrennikova, O. A., & Trofimenko, Yu. Yu. (2017). Computer-tomographic characteristics of root length incisors and canines of the upper and lower jaws in boys and girls with different craniotypes and physiological bite. *Wiadomosci Lekarskie (Warsaw, Poland: 1960)*, *70*(3 pt 1), 499-502. PMID: 28711896

[11] Milos Brandenberg, D., González Espinoza, D., Valenzuela-Fuenzalida, J., Nova-Baeza, P., & Orellana-Donoso, M. (2023). Anatomical Characteristics, Relations, and Clinical Considerations of the Facial Index and Cephalic Index in Young Chileans Aged Between 18 and 21 Years. *International Journal of Morphology, 4*1(6), 1720-1726. doi: 10.4067/S0717-95022023000601720

[12] Mısır, M., Gökcan, S. H., Büncü, A., & Koruyucu, M. (2025). Prevalence and Etiology of Dental Ankylosis in Primary Teeth. *Dent*, *(4)*, 0023. doi: 10.5152/EssentDent.2025.24023

[13] Muralidhar, N. V., Ranjan, A., Rao, J. J., Sreeshyla, H. S., & Nitin, P. (2021). Cephalic index, facial index and dental parameters: A correlative study to evaluate their significance in facial reconstruction. *Journal of Oral and Maxillofacial Pathology*, *25*(3), 537-542. doi: 10.4103/jomfp.jomfp_68_21

[14] Nojima, M. D. C. G., Oliveira, T. C. P., Copello, F. M., Silva, I. M. C. C., & Nojima, L. I. (2020). Cephalometric profile norms for southeastern african-brazilian adults according to the legan-burstone analysis: a pilot study. *Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal)*, *5*(1), 29-34. doi: 10.29327/24816.5.1-6

[15] Noor, N. F. M., Basri, R., Alam, M. K., Haque, S., Hao, M. S. J., & Talib, M. A. (2020). Soft tissue cephalometric measurements among Malaysian Malays and Chinese. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*, *(20)*, e4978. doi: 10.1590/pboci.2020.057

[16] Prachodh, C. A., Antony, V., Shaloob, M., Parayaruthottam, P., Nayaz, M., & Raheesh, M. (2022). Correlation between cephalic index and facial index in skeletal malocclusions–An analytical cross-sectional study. *Journal of Contemporary Orthodontics*, *6*(4), 152-157. doi: 10.4103/jomfp.jomfp_68_21

[17] Qamruddin, I., Alam, M. K., Shahid, F., Tanveer, S., Mukhtiar, M., & Asim, Z. (2016). Assessment of gender dimorphism on sagittal cephalometry in Pakistani population. *J Coll Physicians Surg Pak*, *26*(5), 390-393. PMID: 27225144

[18] Redžepagić Vražalica, L., Ilić, Z., Laganin, S., Džemidžic, V., & Tiro, A. (2017). An epidemiological study of malocclusion and occlusal traits related to different stages of dental development. *South European Journal of Orthodontics and Dentofacial Research*, *4*(1), 9-13. doi: 10.5937/sejodr4-1285

[19] Rosa, W. G. N., Navarro, R. D. L., Conti, A. C. D. C. F., ALMEIDA, M. R. D., & Oltramari-Navarro, P. V. P. (2015). Assessment of cephalometric characteristics in the elderly. *Brazilian oral research*, *(29)*, 1-9. doi: 10.1590/1807-3107BOR-2015.vol29.0040

[20] Ryabov, T. V., Shinkaruk-Dykovytska, M. M., Pylypiuk, O. Yu., Muntian, O. V., Drachevska, I. Yu., Rokunets, I. L., & Burdeina, L. V. (2024). Modeling the parameters necessary for constructing the correct shape of the dental arch depending on the features of teleradiometric indicators using the Steiner or Tweed methods and computed tomography dimensions of teeth in Ukrainian young men and young women with physiological occlusion. *Reports of Morphology*, *30*(4), 29-43. doi: 10.31393/10.31393/morphology-journal-2024-30(4)-04

[21] Salcedo-Ospina, O. B., & Jaramillo-Vallejo, P. M. (2020). Cepha-

lometric assessment of Colombia's mestizo population aged 6 to 12 years. *Revista Facultad de Odontología Universidad de Antioquia, 32*(2), 18-32. doi: 10.17533/udea.rfo.v32n2a2

[22] Siotou, K., Kouskouki, M. P., Christopoulou, I., Tsolakis, A. I., & Tsolakis, I. A. (2022). Frequency and local etiological factors of impaction of permanent teeth among 1400 patients in a Greek population. *Dentistry Journal*, *10*(8), 150. doi: 10.3390/dj10080150

[23] Taner, L., Gürsoy, G. M., & Uzuner, F. D. (2019). Does gender have an effect on craniofacial measurements? *Turkish Journal of Orthodontics*, *32*(2), 59-64. doi: 10.5152/TurkJOrthod.2019.18031

[24] Tweed, C. H. (1954). The Frankfort-Mandibular Incisor Angle (FMIA) in Orthodontic Diagnosis, Treatment Planning and Prognosis. *Angle Orthod, (3),* 121-169. doi: 10.1043/0003-3219(1954)024<0121:TFIAFI>2.0.CO;2

[25] Yin, J., Zhang, H., Zeng, X., Yu, J., Wang, H., Jiang, Y., ... & Zhang, Y. (2023). Prevalence and influencing factors of malocclusion in adolescents in Shanghai, China. *BMC Oral Health*, *23*(1), 590. doi: 10.1186/s12903-023-03187-5

[26] Zhou, Z., Liu, F., Shen, S., Shang, L., Shang, L., & Wang, X. (2016). Prevalence of and factors affecting malocclusion in primary dentition among children in Xi'an, China. *BMC Oral Health*, *(16)*, 91. doi: 10.1186/s12903-016-0285-x

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

Рябов Т. В.

Анотація. *Сучасна ортодонтія активно досліджує взаємозв'язок між краніофаціальними параметрами та морфометричними характеристиками зубних рядів. Особлива увага приділяється пошуку закономірностей між кістковими орієнтирами черепа, формою щелеп та особливостями зубного апарату в осіб із гармонійними рисами обличчя. Такі дослідження важливі для вдосконалення діагностики, прогнозування росту щелепно-лицевої ділянки та планування індивідуалізованого ортодонтичного лікування. Мета дослідження – встановлення особливостей кореляцій між телерентгенометричними показниками за методом Tweed із розмірами зубів і зубних дуг в українських юнаків і дівчат із фізіологічним прикусом із широким типом обличчя. Проведено морфометричне дослідження телерентгенометричних показників за методом Tweed, комп'ютерно-томографічних розмірів зубів і зубних дуг 25 українських юнаків і 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 Tweed і комп'ютерно-томографічними розмірами зубів і зубних дуг проведена у ліцензійному пакеті «Statistica 6.0» за допомогою непараметричної статистики Спірмена. При аналізі достовірних і середньої сили недостовірних кореляцій між телерентгенометричними показниками за методом Tweed та розмірами зубів і зубних дуг в юнаків і дівчат із широким типом обличчя встановлено: в юнаків – 11,22 % подібних зв'язків із розмірами зубів верхньої щелепи (переважно недостовірних прямих середньої сили), 13,67 % із розмірами зубів нижньої щелепи (середньої сили, переважно достовірних і недостовірних прямих і недостовірних зворотних) та 26,98 % із розмірами зубних дуг (переважно середньої сили достовірних і недостовірних прямих і недостовірних зворотних); у дівчат – 14,08 % подібних зв'язків із розмірами зубів верхньої щелепи (переважно недостовірних прямих), 17,55 % із розмірами зубів нижньої щелепи (переважно середньої сили недостовірних прямих і зворотних) та 21,43 % із розмірами зубних дуг (переважно середньої сили прямих достовірних і недостовірних). 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 Tweed та комп'ютерно-томографічними розмірами зубів і зубних дуг.*

Ключові слова: *стоматологія, телерентгенометрія за методом Tweed, конусно-променева комп'ютерна томографія, морфометрія зубів і зубних дуг, українські юнаки та дівчата, широкий тип обличчя, фізіологічний прикус, кореляції, статевий диморфізм.*