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MODELING OF DENTAL ARCH DIMENSIONS IN GIRLS WITH PHYSIOLOGICAL OCCLUSION AND A VERY WIDE FACIAL TYPE DEPENDING ON CEPHALOMETRIC INDICATORS ACCORDING TO THE BURSTONE METHOD AND CT TOOTH DIMENSIONS

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It was established that all 18 possible reliable highly informative regression models of linear dental arch parameters depending on the characteristics of cephalometric indicators according to the Burstone method and CT dimensions of the teeth of the upper and lower jaws were constructed for Ukrainian girls with physiological occlusion and a very wide facial type (coefficient of determination R^2 = from 0.742 to 0.931, $p < 0.001$ in all cases). Analysis of the frequency of inclusion of cephalometric indicators according to the Burstone method and CT tooth dimensions in the regression equations for girls with physiological occlusion and a very wide facial type showed that the models most frequently included cephalometric indicators (28.57 %), crown width in the mesiodistal (22.86 %) and vestibulo-oral (14.29 %) planes. Analysis of the frequency of inclusion of the corresponding teeth in the regression equations for girls with physiological occlusion and a very wide facial type showed that the models most frequently included upper incisors (24.00 %), lower incisors (22.00 %), lower premolars (13.00 %), lower canines and upper premolars (both 11.00 %) and upper canines (10.00 %).

Key words: dentistry, Ukrainian girls with physiological occlusion, facial type, cephalometry according to the Burstone method, CT dimensions of teeth and dental arches, regression analysis.

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МОДЕЛЮВАННЯ РОЗМІРІВ ЗУБНИХ ДУГ У ДІВЧАТ ІЗ ФІЗІОЛОГІЧНИМ ПРИКУСОМ І ДУЖЕ ШИРОКИМ ТИПОМ ОБЛИЧЧЯ В ЗАЛЕЖНОСТІ ВІД ТЕЛЕРЕНТГЕНОГРАФІЧНИХ ПОКАЗНИКІВ ЗА МЕТОДОМ BURSTONE ТА КТ РОЗМІРІВ ЗУБІВ

Встановлено, що для українських дівчат із фізіологічним прикусом і дуже широким типом обличчя побудовані усі 18 можливих достовірних високоінформативних регресійних моделей лінійних параметрів зубних дуг в залежності від особливостей телерентгенометричних показників за методом Burstone та КТ розмірів зубів верхньої й нижньої щелепи (коефіцієнт детермінації R^2 = від 0,742 до 0,931, $p < 0,001$ в усіх випадках). Проведений аналіз частоти входження до регресійних рівнянь телерентгенометричних показників за методом Burstone та КТ розмірів зубів у дівчат із фізіологічним прикусом і дуже широким типом обличчя показав, що до моделей найбільш часто входять телерентгенометричні показники (28,57 %), ширина коронкової частини зубів у мезіо-дистальній (22,86 %) та вестибуло-оральній (14,29 %) площині. Проведений аналіз частоти входження до регресійних рівнянь відповідних зубів у дівчат із фізіологічним прикусом і дуже широким типом обличчя показав, що до моделей найбільш часто входять верхні різці (24,00 %), нижні різці (22,00 %), нижні премоляри (13,00 %), нижні ікла та верхні премоляри (по 11,00 %) та верхні ікла (10,00 %).

Ключові слова: стоматологія, українські дівчата з фізіологічним прикусом, тип обличчя, телерентгенометрія за методом Burstone, КТ розміри зубів і зубних дуг, регресійний аналіз.

The study is a fragment of the research project “Clinical and laboratory substantiation of improving methods for diagnosis, treatment, prediction, and prevention of dental diseases”, state registration No. 0124U000174.

The title of the publication by the Austrian researcher Fornai C. “Why anthropologists and dentists should work in synergy to improve oral health”, is particularly apt. In this work, the author calls for a deeper understanding of the evolutionary causes

underlying orthodontic pathology and for collaboration between anthropologists and dentists in investigating its morphological variations and, through the study of various anthropological aspects, improving the individual health of each population [4].

The human craniofacial complex is characterized by considerable morphological variability resulting from the interaction of multiple factors, including genetic, evolutionary, functional, and environmental influences. Thus, specific features of jaw morphology are associated with population history, the adaptive processes experienced by a particular population group, and the characteristics of functional loading of the masticatory apparatus. Such variability in craniofacial morphology supports the rationale for applying an individualized approach to the assessment of dentofacial parameters and the determination of their normative values, taking into account various characteristics, including facial features [3]. This can be achieved through the application of appropriate anthropometric research methods.

The pronounced anthropological component in the formation of the dentofacial system becomes evident even when differences in the prevalence of orthodontic pathology across continents are considered. South Africa demonstrates the lowest levels of dental crowding; Coloured South Africans have the highest prevalence of crowding, whereas Black South Africans have the lowest. Among Black Americans, the prevalence of crowding is lower than that observed in the general US population, whereas Indigenous populations of North America have demonstrated a high prevalence of severe crowding. In China and Japan, the relative prevalence of severe dental crowding has been reported to be higher than the global average [6].

Despite the numerous studies conducted in this field, research into craniometric and odontological parameters and the relationships between them remains highly relevant. One of the reasons for this is the high prevalence of orthodontic pathology. For example, an examination of schoolchildren in Faridpur, India, showed that 63.33 % of those examined had malocclusion. Among individuals with malocclusion, girls were significantly more prevalent (64.20 %, $p=0.041$). Class I malocclusion was the most common, accounting for 60.67 % of cases. Class II (29.33 %) and Class III (10.00 %) malocclusions were less common. The most frequently observed abnormalities were increased overbite (57.33 %) and dental crowding (53.33 %), while increased overjet (29.33 %), dental spacing (27.33 %), crossbite (11.33 %), and open bite (5.33 %) were less common [1].

Dentofacial pathology is associated not only with aesthetic concerns related to facial appearance but also with the development of concomitant disorders that may impair a patient's quality of life. A review of the literature has demonstrated a strong association between the presence of malocclusion and severe pain resulting from temporomandibular joint pathology in children and adolescents. This is particularly relevant in cases of posterior crossbite, Class II malocclusion, Class III malocclusion, and anterior open bite [13], which, as shown in the preceding paragraph, are relatively common within this age group.

However, orthodontic abnormalities should not be regarded exclusively as diseases of the modern era. Archaeological evidence suggests that they have accompanied humankind since at least the Copper Age, when dental crowding was common. Although an apparent "adaptation" of the dentofacial apparatus was subsequently observed in skeletal remains from the Bronze Age, an increased number of cases of malocclusion associated with dental crowding and hypodontia re-emerged during the Iron Age. By the Middle Ages, the prevalence of malocclusion was approximately 36 %, which was generally lower than that observed in Antiquity [15].

Thus, the need to investigate the relationships between various facial and dental parameters in humans remains a relevant area of research.

The purpose of the study was to develop and analyze regression models of parameters required to construct the correct shape of dental arches in Ukrainian girls with physiological occlusion and a very wide facial type depending on the characteristics of cephalometric indicators according to the Burstone method and CT tooth dimensions.

Materials and methods. From the database of the Research Center and the Department of Pediatric Dentistry of National Pirogov Memorial Medical University, Vinnytsya, primary CT scans were obtained (using a dental cone-beam computed tomography scanner Planmeca ProMax 3D Mid, Finland) and cephalograms (using a dental cone-beam computed tomography scanner Veraviewepocs 3D Morita, Japan) of 30 Ukrainian girls (aged 16 to 20 years) with physiological occlusion and a very wide facial type according to Garson. All examinations were conducted on the basis of voluntary informed consent at the private dental clinic "Vinintermed" and the "Center for Maxillofacial Diagnostics Planmeca 3D". The Bioethics Committee of Vinnytsya National Medical University named after M. I. Pirogov (protocol No. 6 dated 07.05.2025) established that the conducted studies did not contradict the basic bioethical standards of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant WHO provisions, and the laws of Ukraine.

Measurements according to the Burstone (1979) method were performed in the OnyxCeph^{3TM} application, version 3DPro (company Image Instruments GmbH, Germany) using cephalograms obtained by the standard method and generated in 3D Slicer v5.4.0 software with landmarks marked on 3D objects. According to this method, the following linear (mm) and angular (°) indicators were determined [11]: cranial base and horizontal skeletal indicators (distances Ar-Pt, Pt-N, N-A, N-B, N-Pog and angle NAPog); vertical skeletal and dental indicators (distances N-ANS, ANS-Gn, PNS-N, 1u-NF, 1l-MP, 6u-NF, 6l-MP and angle MP-HP); intermaxillary indicators (distances ANS-PNS, Ar-Go, Go-Pog, B-Pog and angle arGoMe/ArGoGn); dentoalveolar indicators (angles OP-HP, Max1-SpP/Max1-NF, Mand1-MeGo/Mand1-Mp and distance A-B).

The dimensions of the teeth and dental arches were assessed 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 previous studies by Marchenko A. V. et al. [7] found no significant differences when comparing CT dimensions of corresponding teeth on the right and left sides, their mean values for the upper and lower jaws were used: 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 small molars (premolars), 15 or 45 – upper or lower second small molars (premolars), 16 or 46 – upper or lower first large molars (molars).

Tooth morphometry included determination of the following distances (mm) [11]: crown width in the mesiodistal (MdK) and vestibulo-oral (VoK) planes; cervical tooth width in the mesiodistal (MdC) and vestibulo-oral (VoC) planes; tooth length (MdLD); crown length in the mesiodistal (MdLK) and vestibulo-oral (VoLK) planes; root length in the mesiodistal (MdLR) and vestibulo-oral (VoLR) planes.

Dental arch morphometry included determination of the following distances (mm) [11]: in the axial (transverse) plane – distances PonPr, PonM, VestBM, 13_23Bugr, 13_23Apx, 33_43Bugr, 33_43Apx, mapex_6, napx_6, dapx_6, dapx_46 and mapx_46; in the sagittal plane – distances DL_C, DL_F and DL_S; in the coronal plane – distances GL_1, GL_2 and GL_3.

Modeling of linear parameters required to construct the correct shape of dental arches depending on the characteristics of cephalometric indicators according to the Burstone method and CT tooth dimensions was performed in the licensed “Statistica 6.0” software package using stepwise regression analysis.

Results of the study. The reliable regression models of linear dimensions required to construct the correct dental arch shape in Ukrainian girls with physiological occlusion and a very wide facial type, depending on the characteristics of cephalometric indicators according to the Burstone method and CT tooth dimensions, are represented by the following equations:

– distance PonPr = $-1.120 + 1.926 \times \text{MdLK42} + 1.331 \times \text{VoLK11} - 0.149 \times \text{ANS-Gn} + 0.488 \times \text{B-Pog} + 1.134 \times \text{MdLK12} + 1.310 \times \text{MdK41} + 0.111 \times \text{NAPog}$ ($R^2=0.746$, $F_{(7,22)}=9.21$, $p<0.001$, Std.Error of estimate=0.985);

– distance PonM = $37.64 + 0.261 \times \text{MP-HP} + 1.519 \times \text{MdLK42} + 1.592 \times \text{VoLK43} - 0.129 \times \text{arGoMe/ArGoGn} - 0.392 \times \text{1u-NF} + 0.151 \times \text{PNS-N} - 1.629 \times \text{MdK44} + 0.864 \times \text{VoK16}$ ($R^2=0.820$, $F_{(8,21)}=11.95$, $p<0.001$, Std.Error of estimate=0.916);

– distance 13_23Bugr = $8.412 + 1.010 \times \text{MdLD12} - 0.056 \times \text{N-A} + 0.696 \times \text{MdLR43} - 0.967 \times \text{MdLR42} + 2.177 \times \text{MdK15} - 0.660 \times \text{VoK16}$ ($R^2=0.742$, $F_{(6,23)}=11.02$, $p<0.001$, Std.Error of estimate=0.699);

– distance 13_23Apx = $34.75 + 0.299 \times \text{OP-HP} - 1.661 \times \text{VoC12} + 0.319 \times \text{MdLR41} + 1.511 \times \text{VoK16} - 1.650 \times \text{VoK12} - 1.111 \times \text{MdK42} - 0.175 \times \text{B-Pog} -$

$0.284 \times \text{VoLK43}$ ($R^2=0.901$, $F_{(8,21)}=23.91$, $p<0.001$, Std.Error of estimate=0.691);

– distance VestBM = $49.98 + 0.953 \times \text{MdLK42} + 0.821 \times \text{VoLK43} - 3.166 \times \text{MdK44} + 1.042 \times \text{VoK16} - 0.451 \times \text{MdLD44} + 1.290 \times \text{MdK14} + 0.126 \times \text{Go-Pog} - 0.140 \times \text{ANS-Gn}$ ($R^2=0.843$, $F_{(8,21)}=14.13$, $p<0.001$, Std.Error of estimate=0.747);

– distance napx_6 = $-2.793 + 3.105 \times \text{MdLK11} - 1.193 \times \text{VoLR12} + 1.620 \times \text{VoLK13} - 1.202 \times \text{MdC41} + 2.038 \times \text{MdK11} + 0.136 \times \text{N-ANS} - 1.370 \times \text{MdK46} + 0.783 \times \text{VoK45}$ ($R^2=0.884$, $F_{(8,21)}=20.02$, $p<0.001$, Std.Error of estimate=1.162);

– distance dapx_6 = $72.26 + 4.524 \times \text{MdK15} - 2.286 \times \text{MdLD14} - 0.812 \times \text{Ar-Go} + 1.348 \times \text{6u-NF} + 2.352 \times \text{VoK14} - 4.001 \times \text{VoK11} + 1.026 \times \text{VoLR13}$ ($R^2=0.872$, $F_{(7,22)}=21.43$, $p<0.001$, Std.Error of estimate=1.729);

– distance mapex_6 = $11.20 + 4.649 \times \text{MdK11} + 0.752 \times \text{1u-NF} + 1.950 \times \text{VoK15} - 1.108 \times \text{MdLR13} - 0.323 \times \text{Ar-Pt} + 0.390 \times \text{A-B} - 1.430 \times \text{MdLK11} + 0.648 \times \text{VoLR41}$ ($R^2=0.871$, $F_{(8,21)}=17.77$, $p<0.001$, Std.Error of estimate=1.219);

– distance 33_43Bugr = $10.60 + 0.371 \times \text{A-B} - 0.532 \times \text{N-A} + 2.502 \times \text{MdK11} + 4.541 \times \text{VoK42} - 2.034 \times \text{MdC13} - 2.125 \times \text{VoC13} - 3.640 \times \text{MdK12} + 1.839 \times \text{MdLK12} - 2.003 \times \text{MdK45} + 2.746 \times \text{MdK42}$ ($R^2=0.875$, $F_{(10,19)}=13.32$, $p<0.001$, Std.Error of estimate=1.188);

– distance 33_43Apx = $46.70 - 8.073 \times \text{MdK44} + 1.389 \times \text{VoLR12} + 3.651 \times \text{VoC42} + 1.639 \times \text{MdK46} - 0.303 \times \text{OP-HP} - 0.825 \times \text{MdLD43} + 1.212 \times \text{VoLK41} - 0.126 \times \text{arGoMe/ArGoGn}$ ($R^2=0.891$, $F_{(8,21)}=21.41$, $p<0.001$, Std.Error of estimate=1.264);

– distance mapx_46 = $61.58 - 0.705 \times \text{VoLK11} + 0.884 \times \text{B-Pog} - 1.768 \times \text{VoK44} + 1.238 \times \text{VoK16} + 0.268 \times \text{N-A} - 1.913 \times \text{VoK45} + 2.209 \times \text{VoK43} - 0.249 \times \text{11-MP}$ ($R^2=0.860$, $F_{(8,20)}=15.34$, $p<0.001$, Std.Error of estimate=1.112);

– distance dapx_46 = $47.63 + 0.720 \times \text{B-Pog} - 0.761 \times \text{VoLK11} + 0.306 \times \text{MdLK41} + 3.282 \times \text{MdK41} - 0.598 \times \text{MdLD14} + 2.151 \times \text{MdC13} - 0.804 \times \text{VoK45}$ ($R^2=0.825$, $F_{(7,21)}=14.16$, $p<0.001$, Std.Error of estimate=1.237);

– distance DL_C = $-1.518 + 1.867 \times \text{MdK11} - 0.220 \times \text{A-B} - 0.728 \times \text{MdK15} + 0.158 \times \text{MdLD13} - 0.038 \times \text{arGoMe/ArGoGn} + 0.150 \times \text{VoLK12} - 0.073 \times \text{6u-NF}$ ($R^2=0.847$, $F_{(7,22)}=17.39$, $p<0.001$, Std.Error of estimate=0.421);

– distance DL_F = $-1.859 + 2.859 \times \text{MdK11} - 0.126 \times \text{MP-HP} + 0.838 \times \text{VoC11} - 1.832 \times \text{MdK42} + 2.124 \times \text{VoK13} - 1.159 \times \text{VoC13} - 0.116 \times \text{A-B} - 0.579 \times \text{MdK15}$ ($R^2=0.931$, $F_{(8,21)}=35.50$, $p<0.001$, Std.Error of estimate=0.349);

– distance DL_S = $-0.714 + 1.263 \times \text{MdK11} - 0.376 \times \text{B-Pog} + 0.100 \times \text{Ar-Go} + 1.317 \times \text{MdK45} + 0.188 \times \text{MdLR41} + 0.256 \times \text{MdLK43} + 0.435 \times \text{VoK46}$ ($R^2=0.874$, $F_{(7,22)}=21.71$, $p<0.001$, Std.Error of estimate=0.585);

– distance GL_1 = $-8.717 - 2.110 \times \text{MdK15} + 0.099 \times \text{OP-HP} + 1.063 \times \text{MdLK42} + 1.093 \times \text{MdK46} + 2.630 \times \text{VoK43} - 1.296 \times \text{MdK44} + 0.967 \times \text{VoLK11} - 0.695 \times \text{MdLD43} + 0.607 \times \text{VoLR41}$ ($R^2=0.888$, $F_{(9,20)}=17.65$, $p<0.001$, Std.Error of estimate=0.728);

– distance $GL_2 = -2.978 + 0.817 \times 11\text{-MP} - 0.172 \times \text{Ar-Go} + 2.811 \times \text{MdK13} - 0.377 \times \text{ANS-PNS} - 1.230 \times \text{VoK12} + 0.058 \times \text{arGoMe/ArGoGn} - 0.405 \times \text{MdLD15} + 1.021 \times \text{MdK41}$ ($R^2=0.903$, $F_{(8,21)}=24.42$, $p<0.001$, Std.Error of estimate=0.769);

– distance $GL_3 = 36.72 - 1.373 \times \text{MdC42} + 5.463 \times \text{MdK43} - 1.675 \times \text{MdK45} - 1.959 \times \text{MdK44} - 0.496 \times \text{MdLD41} - 0.223 \times \text{ANS-PNS} + 0.253 \times 61\text{-MP} - 0.828 \times \text{VoK43}$ ($R^2=0.903$, $F_{(8,21)}=24.45$, $p<0.001$, Std.Error of estimate=0.711);

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

Thus, in girls with physiological occlusion and a very wide facial type, all 18 possible reliable models of linear dental arch parameters depending on the characteristics of cephalometric indicators according to the Burstone method and CT tooth dimensions were constructed (respectively $R^2=$ from 0.742 to 0.931, $p<0.001$ in all cases).

Analysis of the frequency of inclusion of cephalometric indicators according to the Burstone method and CT tooth dimensions in the regression models for girls with physiological occlusion and a very wide facial type showed the following percentages of inclusion of these indicators: crown width in the mesiodistal plane (22.86 %), crown width in the vestibulo-oral plane (14.29 %), cephalometric indicators (28.57 %), tooth length (6.43 %), cervical tooth width in the mesiodistal plane (2.86 %), cervical tooth width in the vestibulo-oral plane (3.57 %), crown length in the mesiodistal plane (7.14 %), crown length in the vestibulo-oral plane (7.14 %), root length in the mesiodistal plane (3.57 %) and root length in the vestibulo-oral plane (3.57 %).

Analysis of the frequency of inclusion of the corresponding teeth in the regression models for girls with physiological occlusion and a very wide facial type showed the following percentages of inclusion: upper incisors (a total of 24.00 %, of which 14.00 % were central incisors and 10.00 % were lateral incisors), lower incisors (a total of 22.00 %, of which 11.00 % were central incisors and 11.00 % were lateral incisors), upper canines (10.00 %), lower canines (11.00 %), upper premolars (a total of 11.00 %, of which 4.00 % were first and 7.00 % were second), lower premolars (a total of 13.00 %, of which 7.00 % were first and 6.00 % were second), upper first molars (5.00 %), lower first molars (4.00 %).

Discussion. In the previous study [11] in girls with physiological occlusion and a wide facial type, all 18 possible reliable models of dental arch parameters depending on the characteristics of cephalometric indicators according to the Burstone method and CT tooth dimensions were also constructed ($R^2=$ from 0.680 to 0.962). Analysis of the frequency of inclusion of CT tooth dimensions and cephalometric indicators according to the Burstone method showed that the models most frequently included cephalometric indicators (27.21 %), crown width in the mesiodistal (13.24 %) and vestibulo-oral (11.03 %) planes, and cervical tooth width in the vestibulo-oral plane (10.29 %). Analysis of the frequency of inclusion of the corresponding teeth showed that the models most frequently included upper (35.35 %) and lower incisors (24.24 %), as well as lower (14.14 %) and upper (10.10 %) canines.

The findings of both Ukrainian and international researchers, as well as the results of our own study, confirm the existence of relationships between various craniofacial structures.

With regard to the findings of Ukrainian researchers, a considerable number of correlations of varying strength and direction were identified among Ukrainian young adults when analyzing Ricketts cephalometric parameters in relation to tooth and dental arch dimensions. In particular, among young men, irrespective of facial type, correlations with maxillary tooth dimensions accounted for 7.76 % of all possible correlations, nearly half of which were direct, statistically significant, and of moderate strength; among young women, irrespective of facial type, they accounted for 9.39 %, all of which were statistically significant, almost all direct, and approximately evenly distributed between moderate and weak correlations. Correlations with mandibular tooth dimensions accounted for 9.39 % in men, with nearly two-thirds being direct, statistically significant, and of moderate strength, and 8.98 % in women, all of which were statistically significant, predominantly direct, and ranged from weak to moderate in strength. Correlations with dental arch dimensions accounted for 24.60 % in men, nearly two-thirds of which were direct, statistically significant, and predominantly of moderate strength, and 10.32 % in women, all of which were statistically significant, predominantly direct, and ranged from moderate to weak in strength [2].

In another study conducted in a Ukrainian population using Steiner and Tweed cephalometric analyses, 18 potentially reliable models with coefficients of determination greater than 0.6 were developed for men (R^2 ranging from 0.835 to 0.973 for models based on Steiner cephalometric parameters and from 0.821 to 0.972 for those based on Tweed parameters, $p<0.001$). In women, 18 models were developed using the Steiner method (R^2 ranging from 0.763 to 0.931, $p<0.001$), and 17 models using the Tweed method (R^2 ranging from 0.733 to 0.952, $p<0.001$). These models made it possible to accurately predict dental arch shape [12].

The findings of international researchers in this field are also substantial and are consistent with the results of our study. Regression analysis demonstrated strong positive correlations between dental arch width and such dentofacial parameters as alveolar arch width, the sum of the mesiodistal diameters of the maxillary incisors, bizygomatic width, bigonial width, and the mean alveolar arch coordination angle (p ranging from <0.1 to <0.001) [8].

A study involving a healthy population with no previous orthodontic treatment revealed greater dental arch widths in men and a decrease in arch

width with an increase in the MP–SN angle in both men and women. Accordingly, the authors emphasize the importance of considering the patient's individual dental arch shape and width when planning orthodontic treatment [9].

Vertical facial morphology is also of considerable importance in orthodontic treatment. According to the study findings, it has a significant influence on mandibular arch length, whereas sagittal facial morphology affects maxillary arch depth. Both of these parameters were found to be influenced to the greatest extent by maxillary and mandibular arch lengths, as well as by maxillary intermolar width [10].

At the same time, the class of malocclusion should also be taken into account, since another study demonstrated a statistically significant difference in maxillary intermolar width between patients with Class I and Class III malocclusions [14].

The age group of the examined individuals is another important factor that should be considered. D. Garib et al. [5] demonstrated that aging is associated with forward displacement of the maxilla and mandible, a reduction in the nasolabial angle, retrusion of the upper and lower lips, a decrease in upper lip thickness, and an increase in the thickness of the lower lip and the soft-tissue chin.

Conclusions

1. In Ukrainian girls with physiological occlusion and a very wide facial type, all 18 possible reliable ($p < 0.001$) highly informative regression models of linear dental arch parameters were constructed based on CT tooth dimensions and cephalometric indicators according to the method of Burstone ($R^2 =$ from 0.742 to 0.931).

2. Analysis of the frequency of inclusion of CT tooth dimensions and cephalometric indicators according to the Burstone method in girls with physiological occlusion and a very wide facial type showed that the most frequently included were: cephalometric indicators (28.57 %), crown width in the mesiodistal plane (22.86 %) and crown width in the vestibulo-oral plane (14.29 %).

3. Analysis of the frequency of inclusion of the corresponding teeth in girls with physiological occlusion and a very wide facial type showed that the most frequently included were: upper incisors (24.00 %), lower incisors (22.00 %), lower premolars (13.00 %), lower canines and upper premolars (both 11.00 %) and upper canines (10.00 %).

Prospects for further research consist of developing a computer program based on established regression equations that enables orthodontists to automatically determine the individual dental arch dimensions of Ukrainian girls with very broad facial types, using telerradiographic parameters (based on the Burstone method) and CT-derived tooth measurements.

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DIAGNOSIS AND TREATMENT OUTCOMES OF ACUTE MEDIASTINITIS FOLLOWING THORACIC ESOPHAGEAL INJURY

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Retrospective study included 47 consecutive patients (20 men and 27 women) aged 32–59 years who were treated for acute mediastinitis secondary to open and closed injuries of the thoracic esophagus at the Department of General Surgery in Azerbaijan Medical University (Baku, Azerbaijan), between January 2000 and December 2025. The causes included foreign body perforation (n=19), iatrogenic injury (n=15), spontaneous esophageal rupture (n=8), penetrating stab or gunshot injuries (n=3), and combined tracheal and esophageal injury following blunt chest trauma (n=2). Diagnosis was based on clinical examination, contrast esophagography, computed tomography, and esophagoscopy. Surgical management included mediastinal and pleural drainage, thoracotomy, primary repair of the esophageal defect whenever feasible, and intensive postoperative care. Computed tomography and contrast esophagography were the most informative diagnostic modalities for identifying esophageal perforation and assessing mediastinal involvement. The findings of this study support the importance of early diagnosis, prompt surgical management, and comprehensive postoperative care as the principal components of successful treatment of acute mediastinitis secondary to thoracic esophageal injury.

Key words: acute mediastinitis, esophageal perforation, thoracic esophagus, esophageal injury, thoracotomy, computed tomography.

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ДІАГНОСТИКА ТА РЕЗУЛЬТАТИ ЛІКУВАННЯ ГОСТРОГО МЕДІАСТИНІТУ ПРИ ТРАВМАХ ГРУДНОГО ВІДДІЛУ СТРАВХОДУ

До ретроспективного дослідження було включено 47 послідовних пацієнтів (20 чоловіків і 27 жінок) віком від 32 до 59 років, які проходили лікування з приводу гострого медіастиніту, вторинного щодо відкритих і закритих ушкоджень грудного відділу стравоходу, на кафедрі загальної хірургії Азербайджанського медичного університету (Баку, Азербайджан) у період з січня 2000 року по грудень 2025 року. Причинами ушкодження стравоходу були перфорація чужорідними тілами (n = 19), ятрогенні ушкодження (n = 15), спонтанний розрив стравоходу (n=8), колото-різани та вогнепальні поранення (n=3), а також поєднане ушкодження трахеї та стравоходу при тупій травмі грудної клітки (n=2). Діагностика ґрунтувалася на клінічному обстеженні, рентгеноконтрастному дослідженні стравоходу, комп'ютерній томографії та езофагоскопії. Хірургічне лікування включало дренування середостіння та плевральних порожнин, торакотомію, ушивання дефекту стравоходу за наявності технічних можливостей та комплексну інтенсивну післяопераційну терапію. Найбільш інформативними методами діагностики для виявлення перфорації стравоходу та оцінки поширеності запального процесу в середостінні виявилися комп'ютерна томографія та контрастне дослідження стравоходу. Отримані результати підтверджують важливість ранньої діагностики, своєчасного хірургічного втручання та комплексного післяопераційного лікування як основних складових успішного лікування гострого медіастиніту, що розвинувся внаслідок ушкодження грудного відділу стравоходу.

Ключові слова: медіастиніт, ураження стравоходу, грудний відділ стравоходу, перфорація стравоходу, хірургічне лікування, комп'ютерна томографія.

Esophageal perforation is one of the most severe emergencies in thoracic surgery because it is associated with the rapid development of mediastinal infection, sepsis, multiple organ failure, and high mortality. Despite advances in diagnostic imaging, antimicrobial therapy, and surgical techniques, delayed diagnosis remains the principal factor

adversely affecting treatment outcomes [2, 5, 6, 8]. Acute mediastinitis is the most serious complication of thoracic esophageal injury and develops as a consequence of contamination of the mediastinum by saliva, gastric contents, digestive enzymes, and microorganisms. The inflammatory process rapidly spreads through the loose mediastinal connective