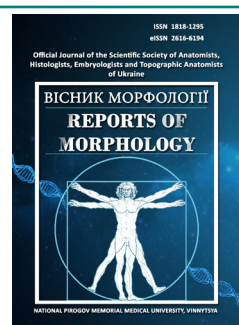




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# Modeling of the linear dimensions required for constructing the correct dental arch form in young males and females with physiological occlusion, regardless of facial type, based on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth measurements

**Orlovskiy I. V.<sup>1</sup>, Beliaiev E. V.<sup>1</sup>, Isakova N. M.<sup>1</sup>, Kasianenko D. M.<sup>1</sup>, Cherkasova L. A.<sup>2</sup>, Dyakova O. V.<sup>1</sup>, Gunas I. V.<sup>1</sup>**

<sup>1</sup>National Pirogov Memorial Medical University, Vinnytsya, Ukraine

<sup>2</sup>Bogomolets National Medical University, Kyiv, Ukraine

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### CORRESPONDING AUTHOR

e-mail: antilitsoooo@gmail.com  
Orlovskiy I. V.

### CONFLICT OF INTEREST

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Not applicable.

### DATA SHARING

Data are available upon reasonable request to corresponding author.

*Proper modeling of dental arch form is one of the key objectives of modern orthodontics, as it determines the stability of both functional and aesthetic treatment outcomes. Most existing approaches are based only on odontometric parameters or take into account facial type, which limits the accuracy of prediction. The use of cephalometric parameters according to the Burstone method combined with computed tomographic measurements of teeth makes it possible to integrate data from different levels, thereby providing a more reliable basis for dental arch modeling. This approach opens opportunities for individualized orthodontic treatment of young males and females with physiological occlusion and for improving its effectiveness. The aim of the study was to develop and analyze regression models of linear dimensions required for constructing the correct dental arch form in Ukrainian young males and females with physiological occlusion, regardless of facial type, depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth measurements. Based on the data bank of the Research Center and the Department of Pediatric Dentistry of the National Pirogov Memorial Medical University, Vinnytsya cephalograms (41 young males and 68 young females with physiological occlusion) were analyzed to obtain linear and angular measurements according to the Burstone method, while computed tomograms were used for morphometric assessment of teeth and dental arches. Regression models of the linear dimensions required for constructing the correct dental arch form, depending on cephalometric parameters and computed tomographic measurements, were built using the licensed software package "Statistica 6.0". It was established that in males, all 18 possible significant models were constructed with a determination coefficient greater than 0.6 ( $R^2$  ranging from 0.694 to 0.894,  $p < 0.001$ ), whereas in females only 10 significant models were obtained ( $R^2$  ranging from 0.605 to 0.775,  $p < 0.001$ ). Analysis of the frequency of inclusion of computed tomographic tooth dimensions and cephalometric parameters into the regression models showed that in males the most frequent predictors were crown width in the mesiodistal plane (26.09 %) and in the vestibulo-oral plane (14.49 %), cephalometric parameters (18.84 %), and tooth length (13.04 %); while in females, cephalometric parameters (28.57 %), crown width and length in the mesiodistal plane (21.42 % and 9.52 % respectively), and tooth length (10.71 %) predominated. When analyzing the frequency of inclusion of individual teeth into the regression models, it was found that in males the most frequent were the maxillary and mandibular incisors (24.11 % and 20.53 % respectively), maxillary and mandibular premolars (16.07 % and 14.28 % respectively), and maxillary canines (10.71 %). In females, the most frequent were maxillary and mandibular incisors*

(43.33 % and 20.00 % respectively), mandibular canines, and mandibular premolars (11.66 % each).

**Keywords:** *dentistry, telerradiometry using the Burstone method, computed tomography dimensions of teeth and dental arches, regression analysis, Ukrainian young males and females, physiological occlusion.*

## Introduction

Modern dentistry and orthodontics face a high prevalence of dentoalveolar system pathologies. The problem is further complicated by the fact that the clinical manifestations of these conditions vary significantly depending on age, sex, sociocultural, and ethnic factors, which necessitates an in-depth investigation of the morphological patterns of growth and dental arch formation in healthy individuals.

According to numerous studies, maxillofacial injuries are among the most common types of bodily trauma. In a retrospective analysis conducted in Qatar, the prevalence of maxillofacial trauma reached 10.6 % among all hospitalized patients, with mandibular fractures (41.4 %) and dental injuries (32.8 %) predominating [1]. Similar results were reported in South Africa, where the share of maxillofacial injuries was 8.4 %, with interpersonal conflicts and traffic accidents being the leading causes [23]. In India, mandibular fractures accounted for more than 55 % of all cases, whereas other fracture sites were significantly less prevalent [27]. Epidemiological studies have shown that 20-25 % of maxillofacial fractures are accompanied by dental injuries, further complicating the clinical course and treatment [25].

The problem of traumatic dental injuries is particularly relevant in children and adolescents. A systematic review and meta-analysis revealed that the prevalence of dental trauma in this age group was 17.5 %, with falls (50-60 %) and sports injuries (20-25 %) being the main etiological factors [5]. A study in the United States among preschool-aged children showed that up to 22.7 % had experienced at least one episode of dental trauma, which was linked to a range of socioeconomic factors and the level of physical activity [9].

Another important orthodontic issue is impacted teeth, which often lead to secondary pathologies and require surgical or orthodontic correction. In a study from Saudi Arabia, the prevalence of impacted teeth was 13.4 %, with third molars (8.6 %) and canines (2.5 %) being the most affected [2]. Another study on an Arab population reported a 2.1 % prevalence of impacted canines [3]. Iranian researchers found that the prevalence of impacted teeth among young adults reached 17.6 %, with mandibular third molars being the most frequently affected [4].

Malocclusions remain the most widespread orthodontic pathology in children and adolescents, regardless of ethnic background. According to a review covering different geographical regions, the overall prevalence of malocclusion ranges from 39 % to 93 %, depending on age and population characteristics [11]. In Turkey, the prevalence among children and adolescents reached 64.4 %, with Angle Class I accounting for 55.7 %, Class II for 32.5 %, and Class III for 11.8 % [18]. Similar data were reported in China, where 45.5 % of children aged 3-5 years were affected, most commonly with sagittal and vertical deviations in

tooth relationships [32]. In Central Anatolia, malocclusion prevalence in adolescents was 56.7 %, with 38 % requiring orthodontic treatment [8]. In Saudi Arabia, prevalence rates ranged from 62 % to 73 %, confirming the global trend of high malocclusion frequency [28].

An important aspect in the study of orthodontic pathology is not only the clinical but also the anthropological perspective. For example, Kenessey D. E. et al. [13] demonstrated that the prevalence of dental crowding is significantly influenced by sociocultural and economic factors. The authors found that in countries with a high level of urbanization, crowding prevalence reached 37-40 %, whereas in traditional societies it was considerably lower – around 20 %. This once again confirms the multifactorial nature of dentoalveolar anomalies.

Thus, the analysis of the literature indicates a high prevalence of both traumatic injuries and orthodontic pathologies across different age groups and populations. Taking these factors into account is crucial in developing scientifically based models of a harmonious dental arch. The use of cephalometric parameters according to Burstone, combined with CT-based measurements of tooth dimensions, opens up new prospects for predictive algorithms that consider not only individual anatomical characteristics but also general patterns of occlusal development.

*The aim of the study* was to develop and analyze regression models of the linear dimensions required for constructing the correct dental arch form in Ukrainian young males and females with physiological occlusion, regardless of facial type, based on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth measurements.

## Materials and methods

From the data bank of the Research Center and the Department of Pediatric Dentistry at the National Pirogov Memorial Medical University, Vinnytsya, primary computed tomograms and cephalograms were obtained for 41 Ukrainian young males (aged 17-21 years) and 68 Ukrainian young females (aged 16-20 years) with physiological occlusion. Computed tomography (using the dental cone-beam CT scanner Planmeca ProMax 3D Mid, Finland) and cephalometric examinations (using the dental cone-beam CT scanner Veraviewepocs 3D Morita, Japan) were performed on the basis of voluntary informed consent at the private dental clinic Vininerm and at the Planmeca 3D Center for Maxillofacial Diagnostics. The Bioethics Committee of the National Pirogov Memorial Medical University, Vinnytsya (Protocol No. 6 dated 07.05.2025) confirmed that the studies conducted did not contradict the main bioethical principles of the Declaration of Helsinki, the Council of Europe Convention

on Human Rights and Biomedicine (1977), the relevant WHO regulations, or the laws of Ukraine.

Measurements according to the Burstone C. J. method [10] were performed in the OnyxCeph<sup>3</sup>™ application, version 3DPro (Image Instruments GmbH, Germany) on standardly obtained teleradiograms created in the 3D Slicer v5.4.0 software with points marked on 3D objects.

According to this method, the following indicators were determined.

*Skull base and horizontal skeletal indices* (Fig. 1):

distance **Ar-Pt** – back of the skull base, distance between points **Ar** and **Pt**, determines the length of the posterior part of the base of the skull, parallel to the horizontal line according to Burstone (HR Line, line drawn through point **N** and seven degrees above **S-N** line) (mm);

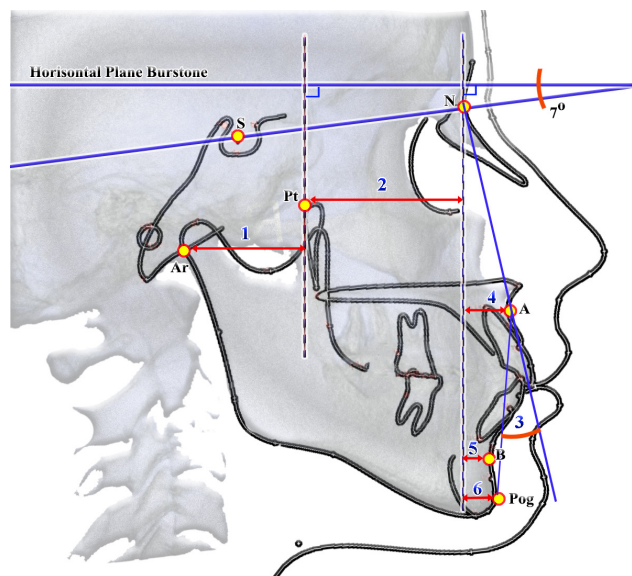
distance **Pt-N** – front part of the skull base, distance from the point **Pt** to **N**, determines the length of the front part of the base of the skull, parallel to the horizontal line by Burstone (mm);

angle **NAPog** – the angle of the skeletal profile, determines the convexity of the face, is formed by lines **N-A** and **A-Pog** (°);

distance **N-A** – distance characterizing the position of the upper jaw, distance from the perpendicular (**N-Vert**) to the horizontal line according to Burstone dropped from the point **N**, and point **A** (mm);

distance **N-B** – distance characterizing the position of the lower jaw, the distance from the perpendicular to the horizontal line according to Burstone dropped from the point **N**, and point **B** (mm);

distance **N-Pog** – distance characterizing the position of the chin, distance from the perpendicular (**N-Vert**) to the horizontal line according to Burstone dropped from the point **N**, and point **Pog** (mm).



**Fig. 1.** Skull base parameters and horizontal skeletal parameters determined by cephalometric methods C. J. Burstone. 1 – distance Ar-Pt; 2 – distance Pt-N; 3 – angle NAPog; 4 – distance N-A; 5 – distance N-B; 6 – distance N-Pog.

*Vertical skeletal and dental indicators* (Fig. 2):

distance **N-ANS** – front upper face height, determines the length of the upper part of the front face height, the distance from the point **N** to **ANS** (mm);

distance **ANS-Gn** – front lower face height, determines the length of the lower part of the front face height from the point **ANS** to **Gn** (mm);

distance **PNS-N** – back top face height, defines the length of the top of the back face height from the point **PNS** to the horizontal line by Burstone (mm);

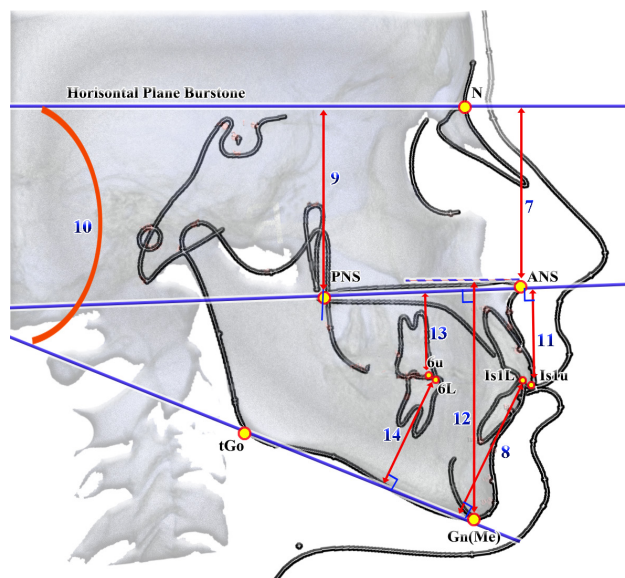
angle **MP-HP** – angle of the lower jaw to the horizontal line according to Burstone, formed by the mandibular plane **tGo-Me** and a line by Burstone (°);

distance **1u-NF** – distance from the cutting edge of the most anterior upper central incisor to the palatal plane, length of the perpendicular to the line **ANS-PNS**, drawn from the point **Is1u** (mm);

distance **1l-MP** – distance from the cutting edge of the most anterior lower central incisor to the mandibular plane, length of the perpendicular to the line **tGo-Me**, dropped from a point **Is1l** (mm);

distance **6u-NF** – distance from the mesial buccal tip of the upper first large canine to the palatal plane, length of the perpendicular to the line **ANS-PNS**, drawn from the point **6u** (mm);

distance **6l-MP** – distance from the mesial buccal tip of the lower first large canine to the mandibular plane, length of the perpendicular to the line **tGo-Me**, dropped from a point **6l** (mm).



**Fig. 2.** Vertical skeletal and dental parameters determined by cephalometric methods C. J. Burstone. 7 – distance N-ANS; 8 – distance ANS-Gn; 9 – distance PNS-N; 10 – angle MP-HP; 11 – distance 1u-NF; 12 – distance 1l-MP; 13 – distance 6u-NF; 14 – distance 6l-MP.

*Inter-jaw indices* (Fig. 3):

distance **ANS-PNS** – length of the upper jaw, distance from the point **ANS** to **PNS** parallel to the horizontal line by



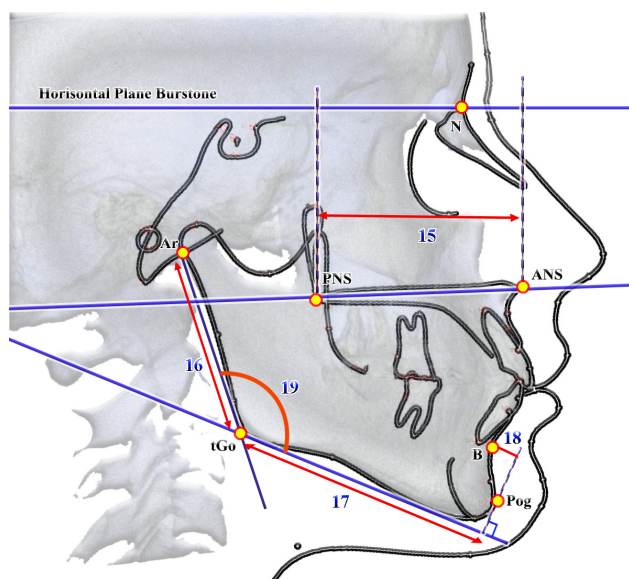
Burstone (mm);

distance **Ar-Go** – length of the mandibular branch, distance from the point **Ar** to **tGo** (mm);

distance **Go-Pog** – length of the base of the lower jaw, distance from the point **Pog** to **tGo** (mm);

distance **B-Pog** – distance from point **Pog** to point **B**, parallel to the mandibular plane (line **tGo-Me**) (mm);

angle **arGoMe/ArGoGn** – gonial angle, angle formed by lines **Ar-tGo** and **tGo-Gn** (°).



**Fig. 3.** Inter-jaw indicators determined by the cephalometric method C. J. Burstone. 15 – distance ANS-PNS; 16 – distance Ar-Go; 17 – distance Go-Pog; 18 – distance B-Pog; 19 – angle arGoMe/ArGoGn.

#### Maxillofacial indicators (Fig. 4):

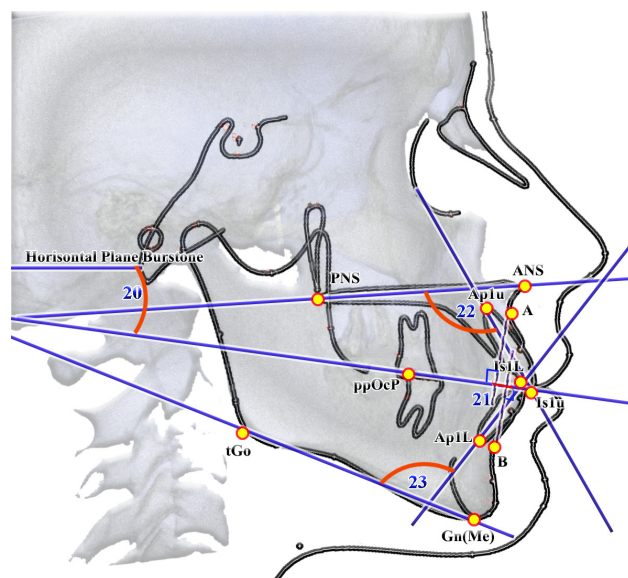
angle **OP-HP** – angle of inclination of the closing plane, the angle formed by the lines **apOcP-ppOcP** and **HR-Line** (°); distance **A-B** – distance from point **A** to the point **B**, on the closing plane (**apOcP-ppOcP**) (mm);

angle **Max1-SpP/Max1-NF** – the angle of inclination of the upper central incisors to the palatal plane, the angle formed by the lines **Ap1u-Is1u** and **ANS-PNS** (°);

angle **Mand1-MeGo/Mand1-Mp** – the angle of inclination of the lower central incisors to the mandibular plane, the angle formed by the lines **Is1L-Ap1L** and **tGo-Gn** (°).

Morphometric study of teeth and dental arches was carried out 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.

In previous studies, no significant differences or tendencies were found when comparing the computed tomographic dimensions of the corresponding teeth on the right and left sides. Therefore, we used the mean values of the corresponding teeth in the maxilla and mandible: 11 or 41 – maxillary or mandibular central incisors, 12 or 42 – maxillary or mandibular lateral incisors, 13 or 43 – maxillary or mandibular canines, 14 or 44 – maxillary or mandibular first premolars,



**Fig. 4.** Dental and maxillofacial parameters determined by cephalometric method C. J. Burstone. 20 – angle OP-HP; 21 – distance A-B; 22 – angle Max1-SpP/Max1-NF; 23 – angle Mand1-MeGo/Mand1-Mp.

15 or 45 – maxillary or mandibular second premolars, 16 or 46 – maxillary or mandibular first molars.

Tooth morphometry included the determination of the following distances (mm) [26]: crown width of the corresponding teeth in the mesiodistal (MdK) and vestibulo-oral (VoK) planes; cervical width of the corresponding teeth in the mesiodistal (MdC) and vestibulo-oral (VoC) planes; tooth length (identical) in the mesiodistal and vestibulo-oral planes (MdLD); crown length of the corresponding teeth in the mesiodistal (MdLK) and vestibulo-oral (VoLK) planes; root length of the corresponding teeth in the mesiodistal (MdLR) and vestibulo-oral (VoLR) planes.

Dental arch morphometry included the determination of the following distances (mm) [26]: between the cusp tips (distance 13\_23Bogr) and root apices (distance 13\_23ApX) of the canines in the maxilla and between the cusp tips (distance 33\_43Bogr) and root apices (distance 33\_43ApX) of the canines in the mandible; between the palatal root apices (distance mapex\_6), mesial vestibular root apices (distance napx\_6), distal vestibular root apices (distance dapx\_6), and mesial vestibular cusps (distance VestBM) of the maxillary first molars and the distal (distance dapx\_46) and mesial (distance mapx\_46) root apices of the mandibular first molars; between premolar (distance PonPr) and molar (distance PonM) Pont's points; 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 maxilla; as well as the distances characterizing the position of the canine (distance GL\_1), premolar (distance GL\_2), and molar (distance GL\_3) lines relative to the hard palate.

By means of the stepwise regression analysis method, using the licensed statistical package "Statistica 6.0," modeling of the linear dimensions required for constructing the

correct dental arch form depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth dimensions was carried out.

## Results

It was established that in Ukrainian *young males* with physiological occlusion, regardless of facial type, the significant regression models (with a determination coefficient  $R^2 > 0.60$ ) of the linear dimensions required for constructing the correct dental arch form, depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth measurements, are represented by the following equations:

*distance PonPr (young males)* =  $10.43 + 1.066 \times \text{MdK12} + 1.425 \times \text{MdK15} - 0.525 \times \text{MdLR12} + 2.571 \times \text{MdK45} + 3.213 \times \text{MdK41} - 0.345 \times \text{MdLD14} + 0.293 \times \text{MdLD11} - 0.315 \times \text{MdLD13} - 0.760 \times \text{MdK46} + 0.153 \times \text{Ar-Pt} - 0.075 \times \text{Pt-N}$  ( $R^2=0.894$ ,  $F_{(11,29)}=22.17$ ,  $p<0.001$ , Std.Error of estimate=0.793);

*distance PonM (young males)* =  $31.31 + 2.184 \times \text{VoK15} + 1.024 \times \text{MdLD44} - 0.463 \times \text{MdLD14} - 0.127 \times \text{Ar-Go\_Gn} + 1.914 \times \text{MdK15} - 1.637 \times \text{VoK42} - 0.100 \times \text{Ar-Pt}$  ( $R^2=0.722$ ,  $F_{(7,33)}=15.95$ ,  $p<0.001$ , Std.Error of estimate=1.351);

*distance 13\_23Bugr (young males)* =  $8.242 + 2.802 \times \text{MdK12} + 2.025 \times \text{MdK13} - 0.760 \times \text{VoLR12} - 0.660 \times \text{VoK14} + 1.416 \times \text{MdK41} + 2.207 \times \text{MdC41} - 1.485 \times \text{VoC41} + 0.315 \times \text{VoLR42} - 0.044 \times \text{PNS-N}$  ( $R^2=0.855$ ,  $F_{(9,31)}=20.37$ ,  $p<0.001$ , Std.Error of estimate=0.867);

*distance 13\_23Apx (young males)* =  $46.02 + 1.758 \times \text{MdC12} - 0.111 \times \text{Ar-Go} + 1.534 \times \text{MdK11} - 1.612 \times \text{VoK16} + 1.587 \times \text{VoK45} - 1.833 \times \text{MdK13} - 1.572 \times \text{VoC43} + 0.453 \times \text{MdLD14} - 0.522 \times \text{MdLR43}$  ( $R^2=0.712$ ,  $F_{(9,30)}=8.23$ ,  $p<0.001$ , Std.Error of estimate=1.399);

*distance VestBM (young males)* =  $31.25 + 1.390 \times \text{VoK15} + 0.820 \times \text{MdLD44} - 0.160 \times \text{Ar-Go\_Gn} - 0.571 \times \text{MdLD14} + 1.868 \times \text{MdK44} + 1.622 \times \text{MdK15}$  ( $R^2=0.805$ ,  $F_{(6,34)}=23.33$ ,  $p<0.001$ , Std.Error of estimate=1.269);

*distance napx\_6 (young males)* =  $37.57 + 2.906 \times \text{MdC42} - 2.669 \times \text{VoK16} + 4.525 \times \text{MdK12} - 0.685 \times \text{VoLR13} + 0.810 \times \text{MdLD45} - 0.914 \times \text{VoLR11} - 0.082 \times \text{N-ANS}$  ( $R^2=0.716$ ,  $F_{(7,33)}=11.90$ ,  $p<0.001$ , Std.Error of estimate=1.873);

*distance dapx\_6 (young males)* =  $-23.49 + 2.973 \times \text{VoK15} + 3.030 \times \text{MdK46} - 5.057 \times \text{MdC13} + 1.121 \times \text{VoLK13} + 2.296 \times \text{MdK12} + 3.425 \times \text{MdK15} + 2.377 \times \text{VoC13} - 1.996 \times \text{MdC16}$  ( $R^2=0.764$ ,  $F_{(8,32)}=12.95$ ,  $p<0.001$ , Std.Error of estimate=2.374);

*distance mapex\_6 (young males)* =  $2.105 + 2.549 \times \text{MdK45} + 3.769 \times \text{MdK15} + 1.767 \times \text{MdK12} + 1.943 \times \text{MdC41} - 0.658 \times \text{MdLR42} + 0.481 \times \text{MdLD44} - 0.752 \times \text{MdLK13} + 1.797 \times \text{MdK41} - 0.116 \times \text{Ar-Go\_Gn} + 0.114 \times \text{OP-HP}$  ( $R^2=0.875$ ,  $F_{(10,30)}=20.99$ ,  $p<0.001$ , Std.Error of estimate=1.354);

*distance 33\_43Bugr (young males)* =  $-3.152 + 1.207 \times \text{MdK12} + 2.501 \times \text{MdK42} - 0.461 \times \text{MdLR11} + 0.356 \times \text{MdLD43} - 0.254 \times \text{VoLR13} - 0.040 \times \text{N-ANS} + 0.224 \times \text{MdLR42} + 0.638 \times \text{MdK46}$  ( $R^2=0.776$ ,  $F_{(8,32)}=13.83$ ,  $p<0.001$ , Std.Error of estimate=0.781);

*distance 33\_43Apx (young males)* =  $21.96 + 0.894 \times \text{MdLD43} - 0.104 \times \text{Pt-N} + 4.782 \times \text{VoK43} - 2.128 \times \text{VoK42} - 2.628 \times \text{VoC43} - 0.449 \times \text{MdLD45} - 2.010 \times \text{MdK15}$  ( $R^2=0.747$ ,  $F_{(7,33)}=13.94$ ,  $p<0.001$ , Std.Error of estimate=1.283);

*distance mapx\_46 (young males)* =  $1.572 + 1.588 \times \text{MdLK12} + 2.105 \times \text{MdK45} + 2.971 \times \text{VoK16} - 0.633 \times \text{MdLD45} - 1.890 \times \text{VoK46} - 0.096 \times \text{Ar-Go} + 3.025 \times \text{MdK42} + 1.515 \times \text{MdK15}$  ( $R^2=0.806$ ,  $F_{(8,31)}=16.11$ ,  $p<0.001$ , Std.Error of estimate=1.343);

*distance dapx\_46 (young males)* =  $40.58 - 0.164 \times \text{Mand1-MP} - 0.172 \times \text{Pt-N} + 2.143 \times \text{VoK16} + 1.953 \times \text{MdK45} + 2.070 \times \text{MdC12} - 0.533 \times \text{MdLR12}$  ( $R^2=0.736$ ,  $F_{(6,33)}=15.36$ ,  $p<0.001$ , Std.Error of estimate=1.584);

*distance DL\_C (young males)* =  $-10.80 + 0.831 \times \text{MdK11} + 0.825 \times \text{VoK41} - 0.359 \times \text{VoLK41} + 0.307 \times \text{VoLK13} + 0.107 \times \text{A-B} + 0.081 \times \text{Ar-Pt} + 0.853 \times \text{MdK44}$  ( $R^2=0.825$ ,  $F_{(7,33)}=22.25$ ,  $p<0.001$ , Std.Error of estimate=0.618);

*distance DL\_F (young males)* =  $4.159 + 1.585 \times \text{MdK11} + 0.820 \times \text{VoK15} - 0.357 \times \text{VoLK42} - 0.715 \times \text{VoK45} + 1.117 \times \text{VoC42} - 0.054 \times \text{Ar-Go\_Gn} + 0.429 \times \text{VoK14} - 0.195 \times \text{MdLR42}$  ( $R^2=0.849$ ,  $F_{(8,32)}=22.42$ ,  $p<0.001$ , Std.Error of estimate=0.670);

*distance DL\_S (young males)* =  $-1.341 + 1.912 \times \text{MdK11} + 0.766 \times \text{VoK15} + 0.253 \times \text{A-B} + 0.595 \times \text{MdLK12} - 0.163 \times \text{MdLK41} + 0.704 \times \text{VoK11}$  ( $R^2=0.860$ ,  $F_{(6,34)}=34.93$ ,  $p<0.001$ , Std.Error of estimate=0.759);

*distance GL\_1 (young males)* =  $7.522 + 0.355 \times \text{N-A-Pog} + 0.415 \times \text{6u-NF} - 0.651 \times \text{VoLR12} + 0.839 \times \text{MdLK13} - 0.126 \times \text{PNS-N} + 1.729 \times \text{VoC41} - 0.526 \times \text{MdLR12}$  ( $R^2=0.707$ ,  $F_{(7,33)}=11.36$ ,  $p<0.001$ , Std.Error of estimate=1.445);

*distance GL\_2 (young males)* =  $10.23 + 3.060 \times \text{VoK12} - 1.148 \times \text{MdLR12} + 0.161 \times \text{N-A-Pog} + 1.000 \times \text{MdLD13} - 0.982 \times \text{MdLD45} + 0.715 \times \text{MdLK11} - 1.904 \times \text{MdK41}$  ( $R^2=0.694$ ,  $F_{(7,33)}=10.68$ ,  $p<0.001$ , Std.Error of estimate=1.604);

*distance GL\_3 (young males)* =  $30.96 + 0.198 \times \text{6u-NF} - 0.085 \times \text{Ar-Go\_Gn} - 0.821 \times \text{MdLD45} + 0.827 \times \text{MdLD11} - 0.075 \times \text{Mand1-MP} - 1.337 \times \text{MdK16} + 2.868 \times \text{MdK42}$  ( $R^2=0.704$ ,  $F_{(7,33)}=11.20$ ,  $p<0.001$ , Std.Error of estimate=1.250);

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

It was established that in Ukrainian *young females* with physiological occlusion, regardless of facial type, the significant regression models (with a determination coefficient  $R^2 > 0.60$ ) of the linear dimensions required for constructing the correct dental arch form, depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth measurements, are represented by the following equations:

*distance 13\_23Bugr (young females)* =  $18.61 + 1.254 \times \text{MdK11} + 1.666 \times \text{VoC12} - 0.153 \times \text{MP-HP} - 0.052 \times \text{MdC43} + 0.447 \times \text{B-Pog} - 0.641 \times \text{VoC11} + 0.271 \times \text{MdLK42} + 0.584 \times \text{VoLK11} - 0.568 \times \text{VoLK43} - 0.084 \times \text{Go-Pog} + 0.108 \times \text{Ar-Pt}$  ( $R^2=0.611$ ,  $F_{(11,56)}=7.88$ ,  $p<0.001$ , Std.Error of estimate=1.160);

*distance 13\_23ApX (young females)* =  $9.787 + 3.071 \times \text{MdK11} + 0.910 \times \text{MdLD45} - 0.537 \times \text{MdLD43} - 2.704 \times \text{VoC11} + 1.526 \times \text{MdC41} + 0.112 \times \text{1I-MP} + 1.645 \times \text{VoK11} - 1.730 \times \text{MdK43} - 0.386 \times \text{MdLD15}$  ( $R^2=0.608$ ,  $F_{(9,58)}=9.98$ ,  $p<0.001$ , Std.Error of estimate=1.652);

*distance mapex\_6 (young females)* =  $-0.898 + 4.351 \times \text{MdK11} + 0.540 \times \text{1u-NF} + 0.715 \times \text{MdLK42} + 3.153 \times \text{VoK12} - 2.567 \times \text{MdC12} - 0.341 \times \text{1I-MP} + 0.454 \times \text{MdLD44} - 2.461 \times \text{VoC11} + 1.670 \times \text{VoK16} - 1.878 \times \text{MdK43}$  ( $R^2=0.606$ ,  $F_{(10,57)}=8.78$ ,  $p<0.001$ , Std.Error of estimate=2.164);

*distance mapx\_46 (young females)* =  $36.41 + 0.697 \times \text{N-Pog} + 0.975 \times \text{MdLK12} - 0.070 \times \text{MdC43} - 0.576 \times \text{N-B} + 1.458 \times \text{MdK41} - 1.342 \times \text{VoK44} + 1.364 \times \text{MdK13}$  ( $R^2=0.701$ ,  $F_{(7,54)}=18.12$ ,  $p<0.001$ , Std.Error of estimate=1.595);

*distance dapx\_46 (young females)* =  $47.90 + 0.562 \times \text{N-Pog} + 0.563 \times \text{VoLR42} - 0.487 \times \text{N-A} + 2.936 \times \text{MdC12} - 1.875 \times \text{MdK44} + 0.718 \times \text{MdLK12} - 1.475 \times \text{MdC41}$  ( $R^2=0.714$ ,  $F_{(7,54)}=19.29$ ,  $p<0.001$ , Std.Error of estimate=1.834);

*distance DL\_C (young females)* =  $-7.488 + 0.451 \times \text{MdK11} + 0.594 \times \text{MdLD11} - 0.263 \times \text{MdLD14} - 0.188 \times \text{B-Pog} + 0.617 \times \text{MdK46} - 0.612 \times \text{VoLK11} + 0.438 \times \text{VoLK12} + 0.674 \times \text{VoK42} - 0.200 \times \text{VoLR42}$  ( $R^2=0.653$ ,  $F_{(9,58)}=12.11$ ,  $p<0.001$ , Std.Error of estimate=0.685);

*distance DL\_F (young females)* =  $-11.27 + 1.014 \times \text{MdK11} + 0.045 \times \text{Mand1-MP} + 0.869 \times \text{VoC11} + 0.803 \times \text{MdK13} - 0.175 \times \text{B-Pog} + 0.512 \times \text{MdK16}$  ( $R^2=0.656$ ,  $F_{(6,61)}=19.41$ ,  $p<0.001$ , Std.Error of estimate=0.847);

*distance DL\_S (young women)* =  $-5.658 + 1.232 \times \text{MdK11} + 0.841 \times \text{MdK45} + 0.293 \times \text{MdLD41} + 0.066 \times \text{Mand1-MP} - 0.437 \times \text{MdLD44} + 0.759 \times \text{MdK16} + 0.239 \times \text{MdLD11} + 0.618 \times \text{MdK44}$  ( $R^2=0.775$ ,  $F_{(8,59)}=25.42$ ,  $p<0.001$ , Std.Error of estimate=0.830);

*distance GL\_2 (young women)* =  $14.73 - 0.199 \times \text{Max1-NF} + 0.654 \times \text{MdLK11} + 0.547 \times \text{6u-NF} + 1.236 \times \text{MdK41} + 0.478 \times \text{MdLK42} - 0.373 \times \text{1u-NF} + 0.331 \times \text{6I-MP} - 0.189 \times \text{ANS-PNS} + 0.733 \times \text{VoK43}$  ( $R^2=0.613$ ,  $F_{(9,58)}=10.21$ ,  $p<0.001$ , Std.Error of estimate=1.603);

*distance GL\_3 (young women)* =  $16.40 + 0.605 \times \text{MdLK12} - 0.334 \times \text{ANS-PNS} + 0.242 \times \text{ANS-Gn_M} - 0.150 \times \text{Op-HP} - 1.251 \times \text{VoC11} + 0.075 \times \text{Ar-Go_Gn} + 0.573 \times \text{MdC11} - 0.166 \times \text{MdLK41}$  ( $R^2=0.605$ ,  $F_{(8,59)}=11.31$ ,  $p<0.001$ , Std.Error of estimate=1.393).

Coefficients of determination of reliable regression equations of the quantity *distance PonPr* ( $R^2=0.369$ ,  $p<0.001$ ), *distance PonM* ( $R^2=0.483$ ,  $p<0.001$ ), *distance VestBM* ( $R^2=0.466$ ,  $p<0.001$ ), *distance napx\_6* ( $R^2=0.442$ ,  $p<0.001$ ), *distance dapx\_6* ( $R^2=0.477$ ,  $p<0.001$ ), *distance 33\_43Bugr* ( $R^2=0.280$ ,  $p<0.001$ ), *distance 33\_43ApX* ( $R^2=0.334$ ,  $p<0.001$ ) та *distance GL\_1* ( $R^2=0.468$ ,  $p<0.001$ ) in Ukrainian young women, without taking into account the type of face, the values were less than 0.60 and therefore have no significant significance for practical dentistry.

## Discussion

Thus, in Ukrainian *young males* with physiological occlusion, all 18 possible significant regression models of

the linear parameters of dental arches depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth dimensions were constructed, with a determination coefficient greater than 0.6 ( $R^2=0.694$  to  $0.894$ ,  $p<0.001$  in all cases).

Analysis of the frequency of inclusion of cephalometric parameters according to the Burstone method and computed tomographic tooth dimensions into the regression equations in Ukrainian *young males* with physiological occlusion showed the following percentage of inclusion into the models: crown width of the tooth in the mesiodistal plane (26.09 %), cephalometric parameters according to the Burstone method (18.84 %), crown width of the tooth in the vestibulo-oral plane (14.49 %), tooth length (13.04 %), root length of the tooth in the mesiodistal plane (6.52 %), cervical width of the tooth in the mesiodistal plane (5.07 %), cervical width of the tooth in the vestibulo-oral plane, crown length of the tooth in the mesiodistal plane, and root length of the tooth in the vestibulo-oral plane (4.35 % each), crown length of the tooth in the vestibulo-oral plane (2.90 %).

Analysis of the frequency of inclusion of the corresponding teeth into the regression equations in Ukrainian *young males* with physiological occlusion showed the following percentage of inclusion into the models: maxillary incisors (24.11 % of all variables, including 8.93 % central incisors and 15.18 % lateral incisors), mandibular incisors (20.53 % of all variables, including 9.82 % central incisors and 10.71 % lateral incisors), maxillary premolars (16.07 % of all variables, including 5.36 % first premolars and 10.71 % second premolars), mandibular premolars (14.28 % of all variables, including 4.46 % first premolars and 9.82 % second premolars), maxillary canines (10.71 %), mandibular canines (5.36 %), maxillary first molars (5.36 %), mandibular first molars (3.57 %).

In Ukrainian *young females* with physiological occlusion, only 10 of the 18 possible significant regression models of the linear parameters of dental arches depending on the characteristics of cephalometric parameters according to the Burstone method and computed tomographic tooth dimensions were constructed, with a determination coefficient greater than 0.6 ( $R^2=0.605$  to  $0.775$ ,  $p<0.001$  in all cases).

Analysis of the frequency of inclusion of cephalometric parameters according to the Burstone method and computed tomographic tooth dimensions into the regression equations in Ukrainian *young females* with physiological occlusion showed the following percentage of inclusion into the models: cephalometric parameters according to the Burstone method (28.57 %), crown width of the tooth in the mesiodistal plane (21.42 %), tooth length (10.71 %), crown length of the tooth in the mesiodistal plane (9.52 %), cervical width of the tooth in the mesiodistal plane (8.33 %), crown width and cervical width of the tooth in the vestibulo-oral plane (7.14 % each), crown length of the tooth in the vestibulo-oral plane (4.76 %), root length of the tooth in the vestibulo-oral plane (2.38 %).

Analysis of the frequency of inclusion of the corresponding teeth into the regression equations in Ukrainian *young females* with physiological occlusion showed the following



percentage of inclusion into the models: maxillary incisors (43.33 % of all variables, including 30.00 % central incisors and 13.33 % lateral incisors), mandibular incisors (20.00 % of all variables, including 10.00 % central incisors and 10.00 % lateral incisors), mandibular canines (11.67 %), mandibular premolars (11.66 % of all variables, including 8.33 % first premolars and 3.33 % second premolars), maxillary first molars (5.00 %), maxillary canines (3.33 %), maxillary premolars (3.33 % of all variables, including 1.67 % first premolars and 1.67 % second premolars), mandibular first molars (1.67 %).

The results obtained in our study confirm the existence of close correlations between the linear parameters of the dental arches and the anthropometric features of the craniofacial region. This is consistent with previous scientific findings demonstrating that cranial and facial morphology plays a key role in the formation of proper occlusion and tooth position.

In patients with hypodontia, the severity of the defect is directly related to changes in craniofacial morphology: with an increasing number of missing teeth, reductions in dental arch length and palatal depth were observed, which influenced occlusal harmony [6]. Similar results were obtained in a Japanese sample, where in patients with congenital tooth absence, facial length and the relationship between basal bones differed significantly from the control group ( $p < 0.05$ ) [29]. Genetic factors have also been highlighted, with evidence that specific gene variations associated with tooth agenesis correlate with distinctive changes in facial morphology [24]. This confirms the multifactorial nature of the issue and emphasizes the need to combine odontometric and cephalometric parameters in modeling dental arches.

Variations in craniofacial structure directly affect the timing and patterns of permanent tooth eruption. In children with a mesofacial type, eruption timing was closer to population averages, whereas dolichofacial patients showed delays [7]. This is particularly important in evaluating arch length during adolescence, since eruption time and tooth position directly determine oral cavity morphology.

Craniofacial morphology also significantly impacts the risk of third molar retention. An analysis of over 1,000 patients showed that a narrow ratio between the mandibular body and ramus increased the likelihood of impaction by 15-20 % [14]. Similar patterns were reported, demonstrating that the number of preserved teeth in the jaw correlates with the length and width of craniofacial structures, further supporting the relationship between overall morphology and the condition of dental arches [21].

Other studies focused on the relationship between vertical and transverse facial parameters and jaw morphology. In dolichofacial individuals, mandibular width was 2-3 mm smaller compared to brachyfacial patients, which is clinically relevant for arch modeling [19]. In males with a vertical facial type, hard palate thickness was reduced by 0.5-0.7 mm, and maxillary width by 2 mm compared to mesofacial counterparts ( $p < 0.01$ ) [20]. Comparable findings were reported among Nigerian adolescents, where vertical facial height correlated

with the overall skeletal pattern ( $r = 0.62$ ), enabling prediction of dental arch morphology from cephalometric data [31].

Cone-beam CT studies revealed correlations between facial growth patterns and cortical bone thickness. In patients with vertical facial types, bone thickness in the molar region was reduced by 20-25 % compared to brachyfacial patients ( $p < 0.01$ ), which is critical for orthodontic tooth movement and treatment stability [12]. A morphometric relationship was also established between the palate and craniofacial morphology in Class III patients: in 68 % of cases, combined palatal narrowing and decreased maxillary width were observed ( $p < 0.05$ ) [22].

Special attention has been given to studies exploring the relationship between aesthetic facial parameters and periodontal tissue characteristics. The facial index and lip profile significantly affect gingival morphology. In males with a broad face, gingival thickness was 0.2-0.3 mm greater than in females ( $p < 0.05$ ) [16]. Likewise, dolichofacial patients were more prone to gingival recession in the mandibular incisor region, while brachyfacial individuals demonstrated more favorable periodontal stability ( $p < 0.05$ ) [17]. Three-dimensional scanning confirmed associations between gingival biotype and cephalometric parameters: a thin biotype was more common among individuals with narrow and elongated faces (57 % vs. 28 %,  $p < 0.01$ ) [30].

Facial height also directly correlates with transverse jaw parameters. It was shown that with increasing facial height, maxillary width decreased by an average of 1.5 mm and mandibular width by 1.2 mm, influencing tooth alignment and occlusal development [15]. These findings align with the results of our study, where we also identified strong correlations between cephalometric indicators and dental arch form.

## Conclusion

1. In Ukrainian young males and females with physiological occlusion, significant ( $p < 0.001$ ) regression models with a determination coefficient greater than 0.6 were constructed for the linear parameters of dental arches depending on the characteristics of computed tomographic tooth dimensions and cephalometric parameters according to the Burstone method (in males all 18 possible models –  $R^2 = 0.694$  to 0.894; in females only 10 models –  $R^2 = 0.605$  to 0.775).

2. When analyzing the frequency of inclusion of computed tomographic tooth dimensions and cephalometric parameters according to the Burstone method into the models, in males the most frequent predictors were crown width of the tooth in the mesiodistal plane (26.09 %), cephalometric parameters (18.84 %), crown width of the tooth in the vestibulo-oral plane (14.49 %), and tooth length (13.04 %); whereas in females – cephalometric parameters (28.57 %), crown width of the tooth in the mesiodistal plane (21.42 %), tooth length (10.71 %), and crown length of the tooth in the mesiodistal plane (9.52 %).

3. When analyzing the frequency of inclusion of the corresponding teeth into the regression models that considered cephalometric parameters according to the Burstone method, in males the most frequently included were

maxillary incisors (24.11 %), mandibular incisors (20.53 %), maxillary premolars (16.07 %), mandibular premolars (14.28 %), and maxillary canines (10.71 %); whereas in

females – maxillary incisors (43.33 %), mandibular incisors (20.00 %), mandibular canines, and mandibular premolars (11.67 % each).

## References

- [1] Al-Hassani, A., Ahmad, K., El-Menyar, A., Abutaka, A., Mekodathil, A., Peralta, R., ... & Al-Thani, H. (2022). Prevalence and patterns of maxillofacial trauma: a retrospective descriptive study. *European journal of trauma and emergency surgery*, 48(4), 2513-2519. doi: 10.1007/s00068-019-01174-6
- [2] Al-wusaybie, M. M., Al-Ramil, A. M., Al-Wosaibi, A. M., & Bukhary, M. T. (2018). Prevalence of impacted teeth and associated pathologies—A radiographic study, Al Ahsa, Saudi Arabia Population. *The Egyptian Journal of Hospital Medicine*, 70(12), 2130-2136. doi: 10.12816/0045040
- [3] Al-Zoubi, H., Alharbi, A. A., Ferguson, D. J., & Zafar, M. S. (2017). Frequency of impacted teeth and categorization of impacted canines: A retrospective radiographic study using orthopantomograms. *European journal of dentistry*, 11(01), 117-121. doi: 10.4103/ejd.ejd\_308\_16
- [4] Arabion, H., Gholami, M., Dehghan, H., & Khalife, H. (2017). Prevalence of impacted teeth among young adults: A retrospective radiographic study. *Journal of Dental Materials and Techniques*, 6(3), 131-137.
- [5] Azami-Aghdash, S., Azar, F. E., Azar, F. P., Rezapour, A., Moradi-Joo, M., Moosavi, A., & Oskouei, S. G. (2015). Prevalence, etiology, and types of dental trauma in children and adolescents: systematic review and meta-analysis. *Medical journal of the Islamic Republic of Iran*, 29(4), 234. PMID: 26793672
- [6] Bajraktarova Miševska, C., Kanurkova, L., Bajraktarova Valjakova, E., Georgieva, S., Bajraktarova, B., Georgiev, Z., & Sotirovska Ivkowska, A. (2016). Craniofacial morphology in individuals with increasing severity of hypodontia. *South European Journal of Orthodontics and Dentofacial Research*, 3(1), 12-17. doi: 10.5937/sejodr3-15218
- [7] Banu, A. M., Șerban, D. M., Pricop, M. O., Urechescu, H. C., Roi, C. I., & Șerban, C. L. (2018). Craniofacial morphology and its relation to the eruption pattern of permanent teeth in the supporting zone of the dentition in a group of Romanian children in Timișoara. *Rom J Morphol Embryol*, 59(2), 491-497. PMID: 30173253
- [8] Bilgic, F., Gelgor, I. E., & Celebi, A. A. (2015). Malocclusion prevalence and orthodontic treatment need in central Anatolian adolescents compared to European and other nations' adolescents. *Dental press journal of orthodontics*, 20(6), 75-81. doi: 10.1590/2177-6709.20.6.075-081.oar
- [9] Born, C. D., Jackson, T. H., Koroluk, L. D., & Divaris, K. (2019). Traumatic dental injuries in preschool-age children: Prevalence and risk factors. *Clinical and experimental dental research*, 5(2), 151-159. doi: 10.1002/cre2.165
- [10] Burstone, C. J., James, R. B., Legan, H., Murphy, G. A., & Norton, L. A. (1979). Cephalometrics for orthognathic surgery. *J Oral Surg*, (36), 269-277. PMID: 273073
- [11] Cenzato, N., Nobili, A., & Maspero, C. (2021). Prevalence of dental malocclusions in different geographical areas: scoping review. *Dentistry Journal*, 9(10), 117. doi: 10.3390/dj9100117
- [12] Gaffuri, F., Cossellu, G., Maspero, C., Lanteri, V., Ugolini, A., Rasperini, G., ... & Farronato, M. (2021). Correlation between facial growth patterns and cortical bone thickness assessed with cone-beam computed tomography in young adult untreated patients. *The Saudi dental journal*, 33(3), 161-167. doi: 10.1016/j.sdentj.2020.01.009
- [13] Kenessey, D. E., Vlemincq-Mendieta, T., Scott, G. R., & Pilloud, M. A. (2023). An anthropological investigation of the sociocultural and economic forces shaping dental crowding prevalence. *Archives of Oral Biology*, 147, 105614. doi: 10.1016/j.archoralbio.2023.105614
- [14] Kindler, S., Ittermann, T., Bülow, R., Holtfreter, B., Klausenitz, C., Metelmann, P., ... & Daboul, A. (2019). Does craniofacial morphology affect third molars impaction? Results from a population-based study in northeastern Germany. *PloS one*, 14(11), e0225444. doi: 10.1371/journal.pone.0225444
- [15] Klinge, A., Beckett, K., Lindh, C., & Beckett, J. P. (2017). Craniofacial height in relation to cross-sectional maxillary and mandibular morphology. *Progress in orthodontics*, 18(1), 32. doi: 10.1186/s40510-017-0187-8
- [16] Kolte, R. A., Kolte, A. P., Kharkar, V. V., & Bawankar, P. (2020). Influence of facial index, facial profile, lip size, and angulations of teeth on gingival characteristics of anterior teeth: A gender-based evaluation. *Journal of Esthetic and Restorative Dentistry*, 32(5), 496-504. doi: 10.1111/jerd.12600
- [17] Kong, J., Hartsfield Jr, J. K., Aps, J., Naoum, S., Lee, R., Miranda, L. A., & Goonewardene, M. S. (2023). Effect of craniofacial morphology on gingival parameters of mandibular incisors. *The Angle Orthodontist*, 93(5), 545-551. doi: 10.2319/101122-700.1
- [18] Londono, J., Ghasemi, S., Moghaddasi, N., Baninajarian, H., Fahimipour, A., Hashemi, S., ... & Dashti, M. (2023). Prevalence of malocclusion in Turkish children and adolescents: A systematic review and meta-analysis. *Clinical and experimental dental research*, 9(4), 689-700. doi: 10.1002/cre2.771
- [19] Mastroianni, D., & Woods, M. G. (2019). 3D-CT assessment of mandibular widths in young subjects with different underlying vertical facial patterns. *Journal of the World Federation of Orthodontists*, 8(2), 78-86. doi: 10.1016/j.ejwf.2019.02.005
- [20] Ning, R., Guo, J., Li, Q., & Martin, D. (2021). Maxillary width and hard palate thickness in men and women with different vertical and sagittal skeletal patterns. *American Journal of Orthodontics and Dentofacial Orthopedics*, 159(5), 564-573. doi: 10.1016/j.ajodo.2019.12.023
- [21] Oeschger, E. S., Kanavakis, G., Cocos, A., Halazonetis, D. J., & Gkantidis, N. (2022). Number of teeth is related to craniofacial morphology in humans. *Biology*, 11(4), 544. doi: 10.3390/biology11040544
- [22] Paoloni, V., Gastaldi, G., Franchi, L., De Razza, F. C., & Cozza, P. (2020). Evaluation of the morphometric covariation between palatal and craniofacial skeletal morphology in class III malocclusion growing subjects. *BMC Oral Health*, 20(1), 152. doi: 10.1186/s12903-020-01140-4
- [23] Pillay, L., Mabongo, M., & Buch, B. (2018). Prevalence and aetiological factors of maxillofacial trauma in a rural district hospital in the Eastern Cape. *South African Dental Journal*, 73(5), 348-353. doi: 10.17159/2519-0105/2018/v73no5a4
- [24] Rodrigues, A. S., Teixeira, E. C., Antunes, L. S., Nelson-Filho, P., Cunha, A. S., Levy, S. C., ... & Antunes, L. A. A.



- (2020). Association between craniofacial morphological patterns and tooth agenesis-related genes. *Progress in orthodontics*, 21(1), 9. doi: 10.1186/s40510-020-00309-5
- [25] Ruslin, M., Wolff, J., Boffano, P., Brand, H. S., & Forouzanfar, T. (2015). Dental trauma in association with maxillofacial fractures: an epidemiological study. *Dental traumatology*, 31(4), 318-323. doi: 10.1111/edt.12176
- [26] Ryabov, T. V. (2025). 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. *Вісник Вінницького національного медичного університету=Reports of Vinnytsia National Medical University*, 29(2), 229-236. doi: 10.31393/reports-vnmedica-2025-29(2)-09
- [27] Saravanan, T., Balaguhan, B., Venkatesh, A., Geethapriya, N., & Karthick, A. (2020). Prevalence of mandibular fractures. *Indian Journal of Dental Research*, 31(6), 971-974. doi: 10.4103/ijdr.IJDR\_286\_18
- [28] Slaghour, M. A., Bakhsh, A. K., Hadi, I. H., Jably, R. M., Alqahtani, M. S., Alqahtani, A. A., ... & Al-Jalooud, A. H. (2019). Dental occlusion and malocclusion: Prevalence, types and treatment. *EC Dental Science*, 18(8), 1776-1783.
- [29] Takahashi, Y., Higashihori, N., Yasuda, Y., Takada, J. I., & Moriyama, K. (2018). Examination of craniofacial morphology in Japanese patients with congenitally missing teeth: a cross-sectional study. *Progress in Orthodontics*, 19(1), 38. doi: 10.1186/s40510-018-0238-9
- [30] Valletta, R., Pango, A., Tortora, G., Rongo, R., Simeon, V., Spagnuolo, G., & D'Antò, V. (2019). Association between gingival biotype and facial typology through cephalometric evaluation and three-dimensional facial scanning. *Applied Sciences*, 9(23), 5057. doi: 10.3390/app9235057
- [31] Yemitan, T. A., Oludare, Y. S., & Ogunbanjo, B. O. (2018). Vertical facial height and its correlation with skeletal pattern among young nigerian orthodontic patients. *Int J Dentistry Oral Sci*, 5(8), 661-666. doi: 10.19070/2377-8075-18000130
- [32] Zhou, X., Zhang, Y., Wang, Y., Zhang, H., Chen, L., & Liu, Y. (2017). Prevalence of malocclusion in 3-to 5-year-old children in Shanghai, China. *International journal of environmental research and public health*, 14(3), 328. doi: 10.3390/ijerph14030328

# **МОДЕЛЮВАННЯ ЛІНІЙНИХ РОЗМІРІВ НЕОБХІДНИХ ДЛЯ ПОБУДОВИ КОРЕКТНОЇ ФОРМИ ЗУБНОЇ ДУГИ В ЮНАКІВ І ДІВЧАТ ІЗ ФІЗІОЛОГІЧНИМ ПРИКУСОМ БЕЗ УРАХУВАННЯ ТИПУ ОБЛИЧЧЯ В ЗАЛЕЖНОСТІ ВІД ОСОБЛИВОСТЕЙ ЦЕФАЛОМЕТРИЧНИХ ПОКАЗНИКІВ ЗА МЕТОДОМ BURSTONE ТА КОМП'ЮТЕРНО-ТОМОГРАФІЧНИХ РОЗМІРІВ ЗУБІВ** **Орловський І. В., Беляєв Е. В., Ісакова Н. М., Касьяненко Д. М., Черкасова Л. А., Дякова О. В., Гунас І. В.**

Правильне моделювання форми зубних дуг є одним із ключових завдань сучасної ортодонції, оскільки воно визначає стабільність функціональних і естетичних результатів лікування. Більшість існуючих підходів ґрунтуються лише на одонтометричних показниках, або враховують тип обличчя, що обмежує точність прогнозування. Використання телерентгенографічних параметрів за методом Burstone у поєднанні з комп'ютерно-томографічними вимірами зубів дозволяє інтегрувати дані різних рівнів, забезпечуючи більш обґрунтоване формування зубних дуг. Такий підхід відкриває можливості для індивідуалізації ортодонтичного лікування юнаків і дівчат із фізіологічним прикусом та підвищення його ефективності. Мета дослідження – розробка та аналіз регресійних моделей лінійних розмірів необхідних для побудови коректної форми зубної дуги в українських юнаків і дівчат із фізіологічним прикусом без урахування типу обличчя в залежності від особливостей телерентгенографічних показників за методом Burstone та комп'ютерно-томографічних розмірів зубів. На отриманих з банку даних науково-дослідного центру та кафедри стоматології дитячого віку Вінницького національного медичного університету ім. М. І. Пирогова телерентгенограмах (41 юнак і 68 дівчат із фізіологічним прикусом) проведено вимірювання лінійних і кутових показників за методом Burstone, а на комп'ютерних томограмах – морфометричне дослідження зубів та зубних дуг. Регресійні моделі лінійних розмірів необхідних для побудови коректної форми зубної дуги в залежності від телерентгенометричних показників і комп'ютерно-томографічних розмірів зубів побудовані за допомогою ліцензійного пакету «Statistica 6.0». Встановлено, що в юнаків побудовані усі 18 можливих достовірних моделей із коефіцієнтом детермінації більшим 0,6 ( $R^2$  = від 0,694 до 0,894,  $p < 0,001$ ); а у дівчат – лише 10 достовірних моделей ( $R^2$  = від 0,605 до 0,775,  $p < 0,001$ ). При аналізі частоти входження до регресійних моделей комп'ютерно-томографічних розмірів зубів і телерентгенометричних показників за методом Burstone встановлено: в юнаків найбільш часто входять ширина коронкової частини зуба у мезіо-дистальній площині (26,09 %) та вестибуло-оральній площині (14,49 %), телерентгенометричні показники (18,84 %) та довжина зуба (13,04 %); у дівчат – телерентгенометричні показники (28,57 %), ширина та довжина коронкової частини зуба у мезіо-дистальній площині (відповідно 21,42 % і 9,52 %) та довжина зуба (10,71 %). При аналізі частоти входження до регресійних моделей відповідних зубів встановлено, що в юнаків найбільш часто входять верхні та нижні різці (відповідно 24,11 % і 20,53 %), верхні та нижні малі кутні зуби (відповідно 16,07 % і 14,28 %) та верхні ікла (10,71 %), а у дівчат – верхні та нижні різці (відповідно 43,33 % і 20,00 %), нижні ікла та нижні малі кутні зуби (по 11,66 %).

**Ключові слова:** стоматологія, телерентгенометрія за методом Burstone, комп'ютерно-томографічні розміри зубів і зубних дуг, регресійний аналіз, українські юнаки та дівчата, фізіологічний прикус.

## **Author's contribution**

Orlovskiy I. V. – research, methodology and writing of the original draft, formal analysis.

Beliaiev E. V. – conceptualization.

Isakova N. M. – review writing and editing.

Kasianenko D. M. – software.

Cherkasova L. A. – data visualization.

Dyakova O. V. – validation.

Gunas I. V. – supervision.