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METHODOLOGICAL ASPECTS OF COMPUTED TOMOGRAPHY ODONTOMORPHOMETRY OF BOYS AND GIRLS WITH THE PHYSIOLOGICAL BITE

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Summary

The article presented data regarding the average mesiodistal, vestibulo-oral and vertical dimensions of the teeth of boys and girls from Ukraine, obtained using cone beam computed tomography. We have studied 101 tomograms, male (n = 44) and female (n = 57) between the ages from 18 to 25 years with orthognathic bite. For this investigation we used dental cone beam computer tomography - Veraviewepocs 3D, Morita. When comparing the performance of odontometric features of the similar teeth from right and left sides, no significant differences were found. Established population characteristics for mesiodistal, vestibulo-oral and vertical dimensions of the teeth for the boys and girls from Ukraine with orthognathic bite. For most sizes of teeth (except mesiodistal size of the second lower premolar) showed significant differences (larger sizes in boys).

Key words: odontometry, computed tomography, the size of the teeth.

Резюме

МЕТОДОЛОГІЧНІ АСПЕКТИ КОМП'ЮТЕРНО-ТОМОГРАФІЧНОЇ ОДОНТОМОРФОМЕТРІЇ У ЮНАКІВ ТА ДІВЧАТ З ФІЗІОЛОГІЧНИМ ПРИКУСОМ. У статті представлені дані щодо середньостатистичних мезіодистальних, вестибуло-оральних та вертикальних розмірів зубів у юнаків та дівчат України отриманих за допомогою конусно-променевої комп'ютерної томографії. Були вивчені 101 томограма представників чоловічої (n = 44) і жіночого (n = 57) статі у віці від 18 до 25 років з ортогнатичним прикусом. Для проведення даного дослідження використовували дентальний конусно-променевий комп'ютерний томограф - Veraviewepocs 3D, Morita. При порівнянні коп'ютернотомографічних метричних характеристик однойменних зубів правої і лівої сторін, достовірних відмінностей виявлено не було. Встановлені популяційні особливості мезіодистальних, вестибуло-оральних і вертикальних розмірів зубів для юнаків та дівчат України з ортогнатичним прикусом. Для більшості розмірів

зубів (за винятком мезіодистального розміру другого нижнього премоляра) встановлені достовірні відмінності (більш великі розміри у юнаків).

Ключові слова: одонтометрія, комп'ютерна томографія, розміри зубів.

Резюме

МЕТОДОЛОГИЧЕСКИЕ АСПЕКТЫ КОМПЬЮТЕРНО-ТОМОГРАФИЧЕСКОЙ ОДОНТОМОРФОМЕТРИИ У ЮНОШЕЙ И ДЕВУШЕК С ФИЗИОЛОГИЧЕСКИМ ПРИКУСОМ. В статье представлены данные относительно среднестатистических мезиодистальных, вестибуло-оральных и вертикальных размеров зубов у юношей и девушек Украины, полученных с помощью конусно-лучевой компьютерной томографии. Были изучены 101 томограмма представителей мужского (n=44) и женского (n=57) пола в возрасте от 18 до 25 лет с ортогнатическим прикусом. Для проведения данного исследования использовали дентальный конусно-лучевой компьютерный томограф – Veraviewepocs 3D, Morita. При сравнении копьютернотомографических метрических характеристик одноименных зубов правой и левой сторон, достоверных различий обнаружено не было. Установлены популяционные особенности мезиодистальных, вестибуло-оральных и вертикальных размеров зубов для юношей и девушек Украины с ортогнатическим прикусом. Для большинства размеров зубов (за исключением мезиодистального размера второго нижнего премоляра) установлены достоверные различия (большие размеры у юношей).

Ключевые слова: одонтометрия, компьютерная томография, размеры зубов.

Analysis of the current scientific literature proves the fact that the issue of the definition of standard indicators numerous anthropogenetic, physiological and psychological characteristics of the functional state of the human body today require the creation of specific metrological concepts that define the concept of "norm", not as a definition of the ideal or predetermined postulate but as certain fundamental category of which depends on the characteristics influence on human a number of factors of internal and environment [1]. So there can be a certain standard value, which is absolute. Each "rule" should be associated with the factors that characterize the existence of certain features of the individual.

In restorative and reconstructive dental practice problems of definition, modeling and predictive assessment of regulatory indicators are standing particularly acute, because they require not only complex of morphological understanding, but also quite accurate morphometric analysis. The basis of most of the diagnostic methods that allow calculate and model the "norm" is the study of the size of the teeth and their relationship with the shape and size of the dental arches, jaw, temporomandibular joint, the shape of the face, head and smile aesthetics. The most common way to measure the parameters of teeth is a measure of the visible part of the tooth crown on diagnostic plaster models produced by a caliper [2, 3]. The complex geometric shape of the tooth, the inconvenience of determining the point of contact, especially in the sides of the dentition, the inability to measure impacted or partially erupted tooth bring to this method certain limitations.

Made available and relatively safe cone beam computed tomography (CBCT) allows with no less accurate make measurements of craniofacial structures, including teeth [4-7], and provides a much greater amount of information that can be used to diagnose and planning treatment. This technique enables to obtain accurate dimensionsnot only the clinical crown, but also morphometric parameters of the entire tooth, including anatomic crown, neck and root of tooth. Also available for studying the characteristics of the root canal, the pulp chamber, the thickness of enamel and dentin.

The aim of this study was to investigate the linear characteristics of teeth of the upper and lower jaw of boys and girls with normal bite using computed tomography.

Materials and methods. We studied 101 tomography representatives male (n=44) and female (n=57) between the ages of 18 to 25 years with normal bite (SRC database VNMU named after Pirogov).To conduct this study was used dental cone beam CT scanner - Veraviewepocs 3D, Morit (Japan). Measured vertical, transversal and mesiodistal size of the crown and root length of incisors, canines and premolars of the upper and lower jaw to the right and left sides, respectively.

Measurements were carried out according to the following protocol: 1) adjusted the brightness and contrast of the image in such a way order to clearly distinguish bone anatomy; 2) the analyzed tooth positioned in a way that its central axis coincide with the three axes of the program.

As a result, we got a glimpse of the object in three windows, and measure the height, width and length, respectively, was carried out three basic planes (Fig. 1).

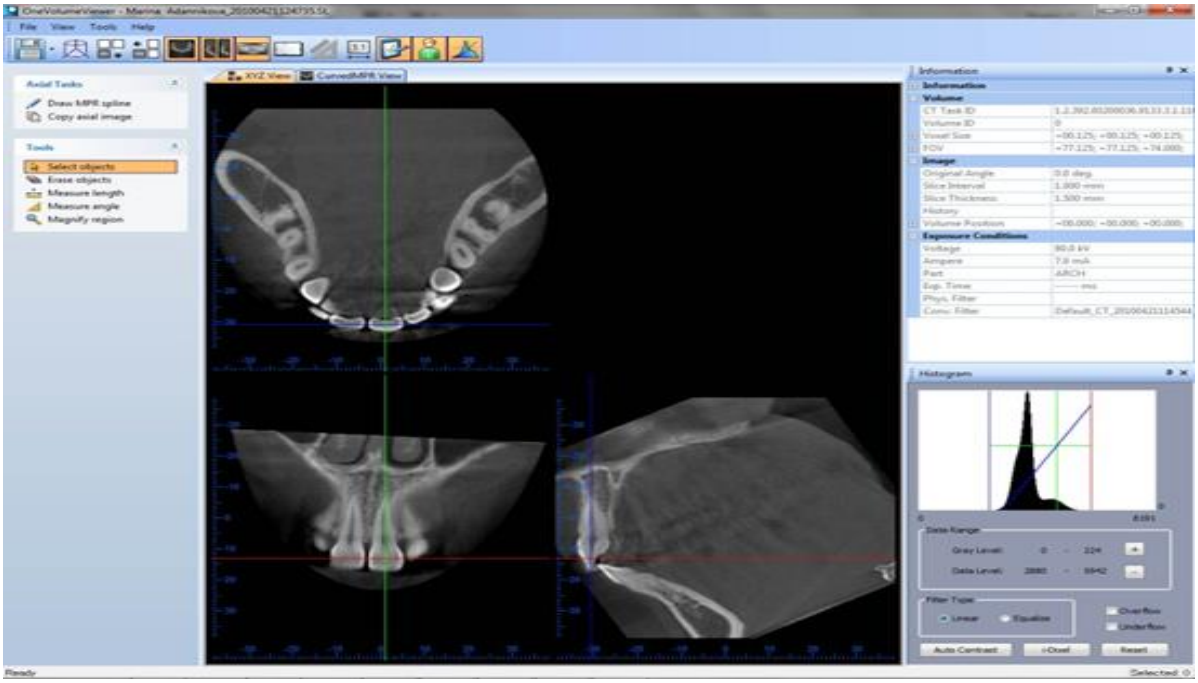

Fig. 1. Positioning of the test tooth according to vertical and sagittal plane.

Measurements of mesial distal, vestibular oral and vertical wire size between the most distant points, respectively, measuring plane (Fig. 2).

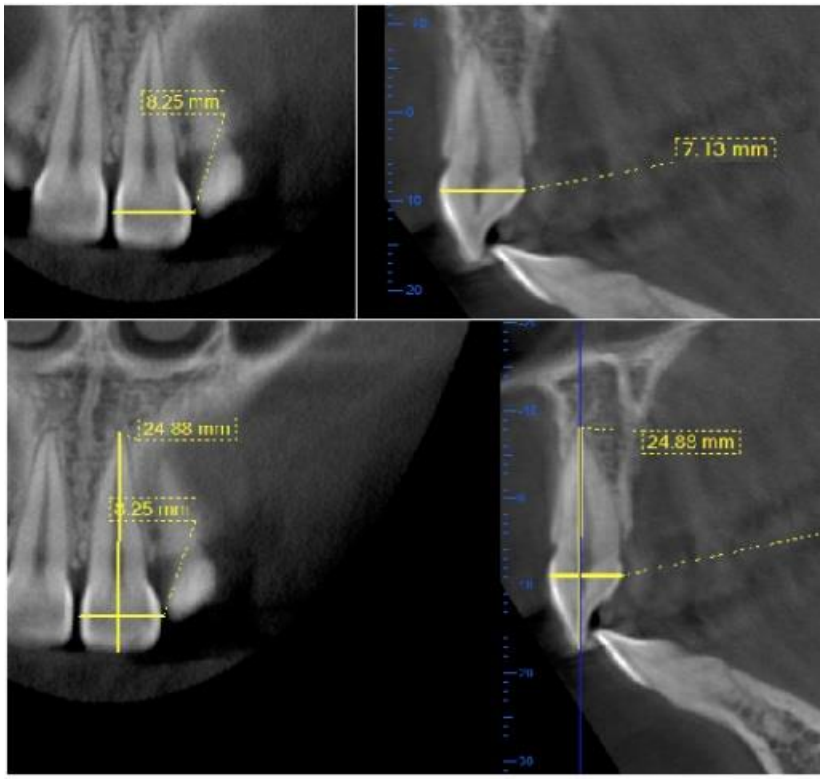

Fig. 2. Measurements mesiodistal, vestibular oral and vertical size of the upper central incisor.

To measure the length of the premolars, we used the distance from the top of the vestibular hill to the top of the vestibular root. To do this, the vertical axis located so that it passes through these points (Fig. 3). Measurements can be made both in the sagittal and in transversal planes.

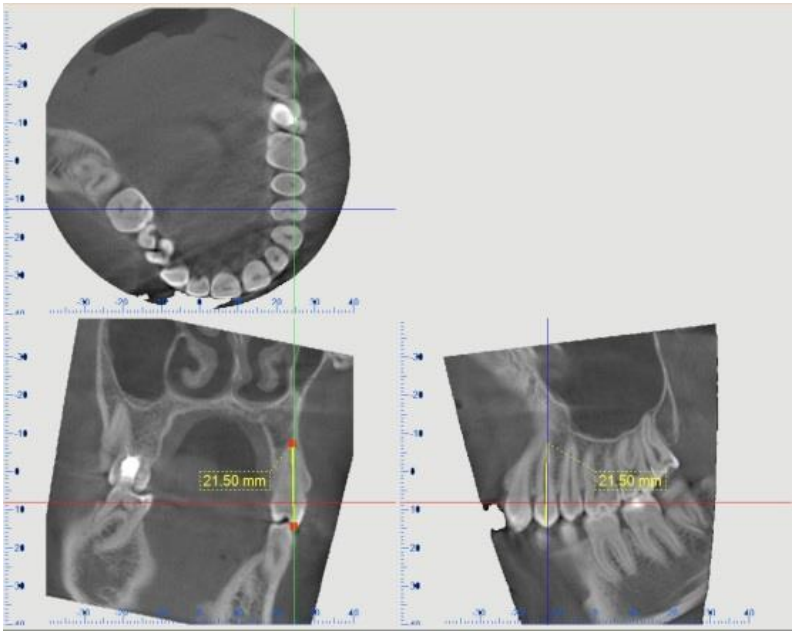

Fig. 3. Measure vertical dimension of the first premolar.

Statistical processing of the results was performed using the statistical software package license "Statistica 6.0" using a non-parametric methods. Estimates the average, standard deviation, quartile range. The significance of differences between independent groups was assessed using U- criterion Mann-Whitney.

The results of the study and discussion. When comparing morphometric characteristics of similar teeth right and left sides, significant differences or trends were not found. This was also confirmed by numerous studies from different nationalities with different kinds of physiological occlusion and dental arches type [8-15], as well as a dairy formed occlusion [16]. In the works where the research was carried out without considering the peculiarities of the bite and various kinds of dentoalveolar anomalies described the presence of significant differences of certain groups of teeth right and left side [17-20]. A similar situation is observed in the study of growing adolescents [21, 22] and in mixed bite [23]. This situation is most likely explained by the fact that the presence of pathology dental rows and the bite may partly be caused by abnormalities of the size of the teeth. In the case study group of the growing people we need to take into account the fact that the size of teeth measured on the diagnostic plaster models are often dependent on the degree of tooth

eruption. Because the morphometric characteristics of similar teeth right and left sides in the current study, no significant differences were found in the future work, we used the average value for the same names teeth right and left sides.

The research results are shown in Tables 1-6.

Table 1. Mesiodistal size of teeth on the upper jaw in boys and girls with orthognathic bite.

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	8,47±0,50	8,13	8,75	8,89±0,52	8,58	9,16	<0,001
The lateral incisor	6,47±0,59	6,20	6,87	6,92±0,48	6,68	7,11	<0,001
Canine	7,62±0,47	7,30	7,89	8,11±0,50	7,86	8,47	<0,001
The first premolar	6,8±0,43	6,50	7,20	7,16±0,32	6,94	7,38	<0,001
The second premolar	6,49±0,45	6,14	6,79	6,68±0,36	6,48	6,90	<0,05

Note: here and in the future

1. M ± σ – average value ± standard deviation;

2. 25p-l, 75p-l (25,00th percentl, 75,00th percentl) – quartile range (75% percentile - 25% percentile);

3 p – significance of differences the sample mean between girls and boys.

Table 2. Mesiodistal size of teeth on the lower jaw in boys and girls with orthognathic bite

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	5,04±0,40	4,89	5,18	5,27±0,33	5,06	5,52	<0,05
The lateral incisor	5,51±0,47	5,26	5,84	5,75±0,27	5,59	5,90	<0,05
Canine	6,31±0,39	6,04	6,56	6,74±0,52	6,36	7,04	<0,001
The first premolar	6,91±0,45	6,68	7,25	7,28±0,36	7,07	7,50	<0,001
The second premolar	7,10±0,52	6,75	7,50	7,19±0,48	6,82	7,60	>0,05

Table 3. Vestibular oral size of teeth on the upper jaw in boys and girls with orthognathic bite

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	7,22±0,50	6,80	7,60	7,65±0,48	7,42	7,89	<0,001
The lateral incisor	6,15±0,50	5,88	6,50	6,69±0,48	6,35	7,00	<0,001
Canine	7,93±0,51	7,58	8,26	8,59±0,47	8,27	8,81	<0,001
The first premolar	9,07±0,72	8,75	9,32	9,61±0,77	9,28	10,07	<0,001
The second premolar	9,14±0,81	8,60	9,58	9,55±0,63	9,17	10,00	<0,05

Table 4. Vestibular oral size of teeth on the lower jaw in boys and girls with orthognathic bite

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	5,71±0,42	5,46	6,00	6,04±0,37	5,71	6,25	<0,001
The lateral incisor	6,21±0,46	5,97	6,54	6,42±0,42	6,25	6,77	<0,05
Canine	7,38±0,50	7,11	7,70	8,11±0,50	7,71	8,50	<0,001
The first premolar	7,53±0,56	7,23	7,81	8,04±0,58	7,72	8,39	<0,001
The second premolar	8,17±0,77	7,70	8,59	8,56±0,65	8,17	8,88	<0,05

Table 5. The vertical size of teeth on the upper jaw in boys and girls with orthognathic bite

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	23,00±1,63	22,13	23,88	25,04±1,53	24,26	26,15	<0,001
The lateral incisor	22,07±1,75	21,13	22,80	24,07±1,54	22,85	24,86	<0,001
Canine	25,26±2,09	23,86	26,70	28,22±1,82	27,19	29,45	<0,001
The first premolar	20,75±1,67	19,74	21,66	22,46±1,61	21,44	23,51	<0,001
The second premolar	20,30±2,05	18,86	21,15	21,83±1,69	20,54	22,77	<0,001

Table 6. The vertical size of teeth on the lower jaw in boys and girls with orthognathic bite

	Girls			Youths			p
	M±σ	25p-l	75p-l	M±σ	25p-l	75p-l	
The central incisor	20,33±1,40	19,38	21,31	21,98±1,33	21,17	22,70	<0,001
The lateral incisor	21,82±1,38	20,77	22,87	23,40±1,39	22,72	24,16	<0,001
Canine	24,12±1,57	23,33	25,00	27,14±1,46	26,24	27,91	<0,001
The first premolar	21,75±1,36	20,88	22,47	23,32±1,54	22,06	24,09	<0,001
The second premolar	21,39±1,82	20,25	22,39	23,32±1,61	22,28	24,55	<0,001

We have found that in almost all cases, the mesial-distal, vestibular-oral and vertical dimensions of the teeth of the young men was significantly higher than that of girls (except mesiodistal size of the second lower premolar, when significant differences are not found, and occurs only an increase in the value of this index in young men in absolute value).

Results of the study indicate that proceeding through statistical odonto metric research is important to consider not only the ethnic and sexual features of the patients, but also take into account the age, and the presence of dentoalveolar anomalies.

The obtained results need further studies to simulate individual dentition standards and planning orthodontic treatment of patients.

Conclusions

1. When comparing the computed tomographic metric characteristics of mesial distal, vestibular-oral and vertical teeth of the same name right and left sides, no significant differences were found.

2. Set computer tomographic population features of mesial distal, vestibular-oral and vertical dimensions of teeth for the boys and girls from Ukraine with orthognatic bite.

3. For most sizes of teeth (except mesial distal size of the second lower premolar) showed significant differences (larger sizes in boys).

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