Determination of standard cephalometric parameters using the Downs method for Ukrainian adolescents

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The difference in the characteristics of craniofacial structures in different races and ethnicities established in many studies requires the creation of a normative basis for teleroentgenographic indices and indices characteristic for a particular ethnic group. The purpose of the work is to set the cephalometric parameters by W. Downs for young men and women from Podillia region of Ukraine with orthognathic bite and compare the results with the data proposed by the author of the technique. With the device Veraviewepocs 3D device, Monita (Japan), 38 young men (17 to 21 years of age) and 55 young women (aged from 16 to 20 years) with orthognathic bite (normal occlusion close to orthognathic bite) received and analyzed lateral teleroentgenograms. Cephalometric points and measurements were performed in accordance with the recommendations of W. Downs (1948). Anatomical points were determined taking into account recommendations A.E. Athanasiou (1997), S.I. Doroshenko and Y.A. Kulginsky (2007). The statistical processing of the obtained results was carried out in the licensed package “Statistica 6.0” using nonparametric methods for evaluating the obtained results. As a result of the research, virtually no sex differences in cephalometric parameters by W. Downs between adolescents from Podillia with orthognathic bite were found. When comparing the cephalometric parameters obtained by W. Downs from similar figures obtained in Ukrainian young men and women with orthognathic bite, regardless of gender, established significantly lower values of Cant Occlusal Plane (angle POr-DOP) and angle II, as well as significantly higher values were established for angle 1l-DOP, angle 1l-MeGo and distance 1u-APog in Ukrainian young men and women of Podillia. The obtained results indicate the need to create a normative base for cephalometric standards by W. Downs for the population of different regions of Ukraine, taking into account gender and age belonging.

Keywords: skull, cephalometry, Downs analysis.

Introduction
One of the first in 1948, William Downs outlined a technique for cephalometric analysis and recommendations for its clinical application as a result of the study of 10 boys and 10 girls aged from 12 to 17 who had "perfect occlusion" [10]. The proposed method consists of ten indicators that are equally divided into skeletal and dental ones. And for a more easy perception and interpretation of the meanings, a graphic polygon [11] with average values for each indicator and the limits of its deviations was developed. According to R. G. Keim et al. [16] method has gained great popularity and was used from 11.1 to 26.3% of dental practitioners from 1986 to 2008. The Center for the Study of Human Growth and Development, at the University of Michigan in 1974, for all indicators based on the study of 83 people aged from 6 to 16 years, were defined average standards for each child's age [18]. But it should be borne in mind that the understanding of true occlusion relates to the harmonious features of the person and takes into account the individual ethnic, age and sexual characteristics, which according to various studies vary considerably [1, 4, 12, 19, 20].

Since in different races and ethnicities the characteristics of craniofacial structures vary considerably, this situation is not caused by any curiosity of researchers with regard to the study and creation of a normative basis for teleroentgenographic indices and indices characteristic of a particular ethnic group [3, 4, 13, 17, 21]. As these studies indicate significant variations in the various cephalometric indices, the question arises as to the correctness of the application of normative data obtained in
The purpose of the study was to establish cephalometric parameters by W. Downs in young men and women from Podilia region of Ukraine with orthognathic bite and compare results with the data suggested by the author of the technique.

Materials and methods

With the device Veraviewepocs 3D device, Morita (Japan), 38 young men (17 to 21 years of age) and 55 young women (aged from 16 to 20 years) with orthognathic occlusion (normal occlusion close to orthognathic bite) received and analyzed lateral teleroentgenograms.

Cephalometric points and measurements were carried out in accordance with the recommendations of W. Downs [10]. Anatomical points were determined taking into account the recommendations of A. E. Athanasiou [2] and S. I. Doroshenko and Y. A. Kulgin [9].

According to the method of W. B. Downs studied the following indicators (Fig. 1, Fig. 2):
- angle POr_NPog - Facial Depth, angle formed by the reference lines Po-Or and N-Pog;
- angle NAPog - Angle of Convexity, formed by the reference lines N-A and A-Pog;
- angle AB_NPog - AB Plane Angle, formed by the reference lines A-B and N-Pog (angle of the plane A-B, defines the position of the plane A-B in relation to the N-Pog);
- angle POr_MeGo - Mandibular Plane Angle, angle between the mandibular plane and the Frankfurt Horizontal, formed by the reference lines Po-Or and Me-Go;
- angle POr_GnS - Y-Axis, determines the cant of the y-axis in relationship to the Frankfurt Horizontal, formed by the reference lines P-Or and S-Gn;
- angle POr_DOP - Cant of Occlusal Plane, determines the angle of the occlusal plane in relationship to the Frankfurt Horizontal, formed by the reference lines Po-Or and ADP-DOP (occlusal plane);
- angle II - II, angulation of axes of upper to lower incisor, formed by the reference lines Ap1u-I1u (central axes of the
upper central incisor) and $\text{Ap1L-Is1L}$ (central axes of the lower incisor);

- **angle 1l_DOP** - formed by the reference lines $\text{Ap1L-Is1L}$ (central axes of the lower incisor) and $\text{ADP-PDP}$ (occlusal plane), measures of deviation from the right angle with a positive value in the direction of the clockwise, with a negative if counterclockwise;

- **angle 1l_MeGo** - Determines the position of the axes of the mandibular incisors ($\text{Ap1L-Is1L}$) in relationship to the mandibular plane ($\text{Me-tGo}$);

- **distance 1u_APog** - distance from the incisal edge of the most prominent upper incisor ($\text{Is1u}$) to the reference line $\text{A-Pog}$.

The statistical processing of the obtained results was carried out in the licensed package "Statistica 6.0" using nonparametric methods for evaluating the obtained results.

**Results**

The cephalometric parameters by W. Downs (mean with standard deviation and percentile velocity) in young men and women from Podillia region of Ukraine with orthognathic bite are presented in Table 1.

When comparing cephalometric parameters by W. Downs between young men and women from Podillia region of Ukraine with orthognathic bite, only significantly higher ($p<0.05$) values of Cant of Occlusal Plane ($\text{POr-DOP}$) were found in young women (see Table 1).

When comparing the cephalometric parameters obtained by W. Downs with the indices obtained in young men and women from Podillia with orthognathic bite, we, in contrast to the cephalometric parameters by W. Downs, revealed pronounced sexual differences [5-8, 14, 15].

Comparing the cephalometric parameters obtained by W. Downs with the magnitude of the data obtained in the young men and women of Podillia with orthognathic bite, we established the pronounced differences only in the dental parameters, namely: significantly lower values of Cant Occlusal Plane (angle $\text{POr-DOP}$) and angle II (which describes both the vertical and horizontal parameters of the closing of the incisors and in clinic, is very important in the consideration of the stable position of the incisors and their operation [10]), and also significantly higher values of the angle 1l-DOP (which allows to estimate the location of the lower incisor to

### Table 1. Limits of percentile scope (25p-1-75p-1) telerentgenographic indicators by the Downs method in Ukrainian boys and girls with orthognathic bite.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Young men</th>
<th>Young women</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$M\pm \sigma$</td>
<td>25p-1, 75p-1</td>
<td>$M\pm \sigma$</td>
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<tr>
<td></td>
<td>1.388±4.786</td>
<td>-2.3 - 5.3</td>
<td>0.996±5.077</td>
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<td></td>
<td>-4.772±2.979</td>
<td>-6.3 - -2.6</td>
<td>-4.135±2.912</td>
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<td></td>
<td>19.95±6.23</td>
<td>16.1 - 24.1</td>
<td>21.89±4.44</td>
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<td></td>
<td>57.64±3.85</td>
<td>56.2 - 59.9</td>
<td>58.02±3.06</td>
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<td><strong>Dental analysis</strong></td>
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</table>

Notes: $M\pm \sigma$ - average ± standard deviation; $p$ - the reliability of sizes differences between young men and women.
A cephalometric study. APOStrends in Orthodontics, 3(51), 137-151. doi: 10.4103/2321-1407.119095


Дімтрев М. О.

Встановлено в багатьох дослідженнях відмінність характеристик краніофаціальних структур у різних рас та етносів внаслідок створення нормативної бази для телерентгенографічних показників та індексів, характерних для певної етнічної групи. Це потребує створення цефалометричних нормативів для відповідної раси або етноса.

ОПРЕДЕЛЕНИЕ НОРМАТИВНЫХ ЦЕФАЛОМЕТРИЧЕСКИХ ПАРАМЕТРОВ МЕТОДОМ W.DOWNS ДЛЯ УКРАИНСКИХ ЮНОШЕЙ И ДЕВУШЕК

Дмитрев Н. А.

Установленные во многих исследованиях различия характеристик крано-фациальных структур в различных рас и этносах требуют создания нормативной базы для телерентгенографических показателей и индексов, характерных для определенной этнической группы. Цель работы - установить цефалометрические параметры по W. Downs у юношей и девушек Подольского региона Украины с ортогнатическим прикусом и сравнить результаты с данными, полученными для аналогичных показателей у украинских юношей и девушек с ортогнатическим прикусом.

В результате проведенных исследований практически не обнаружено половых различий цефалометрических параметров по W. Downs, между юношами и девушками Подолья с ортогнатическим прикусом. При сравнении цефалометрических параметров, полученные W. Downs от аналогичных показателей, полученных от украинских юношей и девушек с ортогнатическим прикусом независимо от пола, установлены достоверно меньшие значения наклона окклюзионной плоскости (угол POIr-DOP) и угла II, а также достоверно большие значения величины угла 1DOP, угла 1MeGo и расстояния 1u-APog у юношей и девушек Подолья.

Ключевые слова: череп, цефалометрия, анализ Downs.


