Features of Teleroentgenographic Indicators of the Position of the Teeth and the Profile of the Soft Tissues of the Face in Adolescents with Different Profiles and Types of Faces According to Schwarz A.M.

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Abstract

One of the most relevant areas of research in biomedical anthropology is the establishment of morphometric parameters of the human body, individual organs and structures of the body, in particular cephalometric indicators and indicators of the jaw-facial apparatus. Such research is important from the point of view of practical medicine, first of all improvement of methods of identification of the person in forensic medicine and for creation of a normative database for diagnostics of dental deformities and improvement of consequences of surgical, orthopedic and orthodontic interventions. One of the most accurate and effective methods for determining cephalometric parameters is the method of lateral teleroentgenography. The object: to establish teleroentgenographic indicators that characterize the position of teeth and the profile of facial soft tissues and determine their sexual characteristics in Ukrainian young men and young women with orthognathic occlusion depending on the profiles and types of faces according to Schwarz A. M. Conclusions: the results prove the need to consider not only age, but also sex, type and profile of the face for an individualized approach in determining the normative teleroentgenographic indicators of human, are important in forensic medicine to improve the efficiency of identification and in practical dentistry to assess the condition of the dental apparatus and ensure effective therapeutic and aesthetic results of orthopedic and orthodontic dentistry.

Key words: *forensic odontology, identification, cephalometry, Schwarz method.*

Introduction

One of the most relevant areas of research in biomedical anthropology is the establishment of morphometric parameters of the human body in general and individual organs and structures of the body in particular. This fully applies to both cephalometric indicators and indicators of the jaw-facial apparatus. Such research is important from the point of view of practical medicine, first of all improvement of methods of identification of the person in forensic medicine. [5, 15, 16]

The definition of biometric indicators for assessing the role of constitutional factors in the development of diseases is indisputable and increasingly relevant;

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in dentistry, to create a regulatory database for the diagnosis of dental-jaw deformities and improve the consequences of surgical, orthopedic and orthodontic interventions; sports medicine – first of all, to determine the most promising people in certain sports. [2, 19, 23] One of the most accurate and effective methods of determining cephalometric parameters is the method of lateral teleroentgenography, which allows the analysis and determination of not only qualitative characteristics but also quantitative indicators of both bone structures of the head and soft tissues of the face.[1]

The aim of the work is to establish teleroentgenographic indicators that characterize the position of teeth and the profile of facial soft tissues and determine their sexual characteristics in Ukrainian young men and young women with orthognathic occlusion depending on the profiles and types of faces according to Schwarz A. M.

Materials and Methods

We analyzed lateral teleroentgenograms of young people in Ukraine – 49 young men (YM) aged 17 to 21 years and 76 young women (YW) aged 16 to 20 years with a physiological bite as close as possible to orthognathic. Both YM and YW were divided into 6 separate study groups depending on the profile or type of person according to Schwarz A. M. [24, 25]

Teleroentgenographic study was performed on a dental cone-beam tomograph Veraviewepocs 3D Morita (Japan) followed by analysis using a licensed program OnyxCeph³ ☐, a version of 3DPro (Germany), developed for image analysis in dentistry.

Cephalometric points were determined according to the recommendations of Phulari B. S. [18] and Doroshenko S. I., Kulginsky E. A. [7]

Teleroentgenographic indicators of the position of the teeth and the profile of the soft tissues of the face were determined according to the method of Schwarz A. M. [24, 25] (Fig. 1).

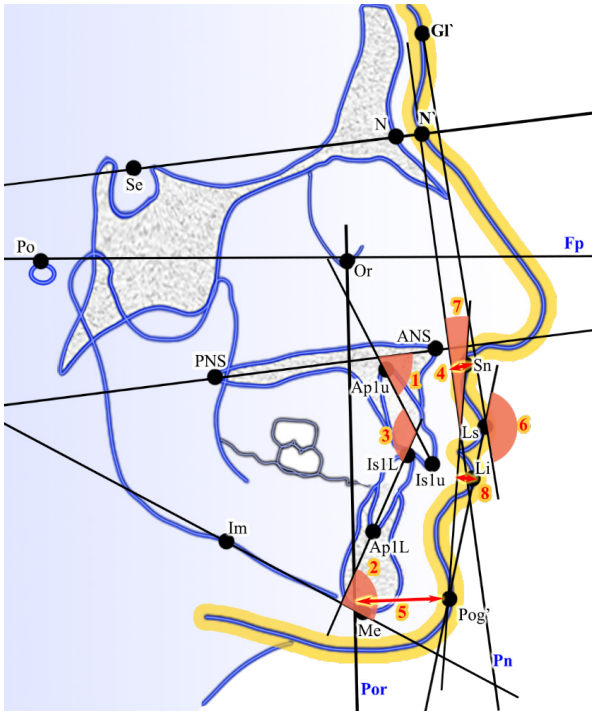

Fig. 1. Teleroentgenographic indicators of the position of the teeth and the profile of the soft tissues of the face according to the method of Schwarz A. M.: 1 – angle Max1-SpP S-arz; 2 – angle Mand1-MP Schwars; 3 – angle II; 4 – distance Sn-Pn; 5 – Pog'-Por distance; 6 – angle Gl'LsPog'; 7 – angle SnPog'-Pn; 8 – distance Li-SnPog'.

Statistical mathematical processing of the research results was performed in the licensed package "Statistica 6.0" using non-parametric methods of evaluation of the obtained results. The reliability of the difference between the values between the independent quantitative values was determined using the U-test of Mann-Whitney.

Results

When comparing the values of the angle Max1-SpP S-arz in YM found higher values of this indicator: in the group with the first profile of the face (1PF), compared with the second (2PF) and third profiles (3PF) (respectively, $p<0.05$ and $p<0.01$); in representatives with the first (1TF) and second type (2TF) of face compared with the third type (3TF) (respectively, $p<0.001$; $p<0.05$) (Table 1). This figure is higher in YW 2TF than in YW 1TF ($p<0.05$) (see Table 1). The angle of Max1-SpP S-arz is higher in YM 1TF ($p<0.05$) and 1PF ($p=0.092$) compared to YW with the corresponding profile or face type (see Table 1).

Table 1. Teleroentgenographic indicators by the method of Schwarz A.M., which characterize the position of the teeth in YM and YW with different profiles, or with different face types.

Groups	Young men			Young women			p
	(M±σ)	p!-!		(M±σ)	p!-!		
Max1-SpP S-arz (°)							
Profile 1	71,70±5,02	p1-2	<0,05	69,57±5,76	p1-2	>0,05	=0,092
Profile 2	67,44±4,80	p1-3	<0,01	68,60±4,15	p1-3	>0,05	>0,05
Profile 3	66,71±5,42	p2-3	>0,05	67,75±6,64	p2-3	>0,05	>0,05
Type 1	72,85±3,60	p1-2	>0,05	68,70±5,44	p1-2	>0,05	<0,05
Type 2	70,22±5,19	p1-3	<0,001	69,71±5,65	p1-3	>0,05	>0,05
Type 3	65,50±5,06	p2-3	<0,05	68,14±6,22	p2-3	>0,05	>0,05
Mand1-MP Shwars (°)							
Profile 1	83,96±6,26	p1-2	>0,05	84,59±5,46	p1-2	>0,05	>0,05
Profile 2	84,22±8,01	p1-3	>0,05	86,93±7,20	p1-3	<0,05	>0,05
Profile 3	85,35±8,82	p2-3	>0,05	87,96±7,93	p2-3	>0,05	>0,05
Type 1	89,62±4,89	p1-2	<0,05	86,39±4,76	p1-2	>0,05	=0,081
Type 2	84,67±7,24	p1-3	<0,001	88,00±6,81	p1-3	>0,05	>0,05
Type 3	80,61±7,06	p2-3	>0,05	84,34±7,74	p2-3	=0,056	>0,05
II (°)							
Profile 1	133,1±5,4	p1-2	>0,05	129,7±8,2	p1-2	=0,096	=0,054
Profile 2	132,2±7,8	p1-3	>0,05	133,4±7,2	p1-3	<0,05	>0,05
Profile 3	134,8±10,4	p2-3	>0,05	134,3±8,7	p2-3	>0,05	>0,05
Type 1	137,6±5,2	p1-2	=0,097	131,3±8,1	p1-2	>0,05	<0,05
Type 2	134,8±8,4	p1-3	<0,01	134,0±7,7	p1-3	>0,05	>0,05
Type 3	129,3±6,9	p2-3	<0,05	130,6±9,0	p2-3	=0,083	>0,05

In YW 3PF, the value of the angle Mand1-MP Shwars is greater than in YW 1PF ($p<0.05$); and in YW 2TF – than in YW 3TF ($p=0.056$) (see Table 1). The Mand1-MP Shwars angle in YM 1TF is greater than in YM 2TF and 3TF (respectively, $p<0.05$ and $p<0.001$) (see Table 1). The magnitude of the Mand1-MP Shwars angle is greater ($p=0.081$) in YM with 1TF than in YW with the corresponding face type (see Table 1).

Angle II in YW 3PF and 2PF is greater than in YW 1PF (respectively $p<0.05$ and $p=0.096$); and YW 2TF – larger than YW 3TF ($p=0.083$) (see Table 1). The value of the angle II have higher values: in YM 1TF and 2TF than in YM with 3TF (respectively, $p<0.01$ and $p<0.05$), as well as in YM 1TF than in YM 2TF ($p=0.097$) (see table. 1). Angle II values were found to be higher in YM 1TF ($p<0.05$) and 1PF ($p=0.054$) than in YW with the corresponding type or facial profile (see Table 1).

In YM 3TF and 2TF the distance Sn-Pn is greater than in YM 1TF (respectively $p<0.01$ and $p=0.093$) (Table 2). In YW 3TF and 2TF, the Sn-Pn distance is greater than in YW 1TF and 2TF (respectively, $p<0.001$ and $p<0.01$); also the value of this indicator is higher in YW 2TF than in YW 1TF ($p=0.085$) (see Table 2). YM 1PF and 2TF have a greater Sn-Pn distance ($p<0.05$ in both cases) than YW with the corresponding profile or face type; also in YM with 3TF – higher than in YW 3TF ($p=0.054$), and in YM 1TF – higher than in YW 1TF ($p=0.084$) (see Table 2).

Table 2. Teleroentgenographic parameters of soft tissues of the face by the method of Schwarz A.M. in YM and YW with different profiles, or with different face types.

Groups	Young men			Young women			p
	(M±σ)	$p_{!-!}$		(M±σ)	$p_{!-!}$		
Sn-Pn (мм)							
Profile 1	12,70±3,56	p_{1-2}	>0,05	10,30±3,47	p_{1-2}	>0,05	**<0,05**
Profile 2	12,78±4,12	p_{1-3}	>0,05	10,60±3,54	p_{1-3}	>0,05	>0,05
Profile 3	12,47±4,93	p_{2-3}	>0,05	9,875±3,366	p_{2-3}	>0,05	>0,05
Type 1	10,23±2,65	p_{1-2}	**=0,093**	8,044±3,735	p_{1-2}	=0,085	=0,084
Type 2	12,22±3,80	p_{1-3}	**<0,01**	9,917±3,020	p_{1-3}	**<0,001**	**<0,05**
Type 3	14,78±4,29	p_{2-3}	>0,05	12,21±2,18	p_{2-3}	**<0,01**	**=0,054**
Pog'-Por (мм)							
Profile 1	20,17±5,19	p_{1-2}	**<0,05**	19,30±4,67	p_{1-2}	**<0,01**	>0,05
Profile 2	24,89±3,55	p_{1-3}	**<0,001**	22,40±3,62	p_{1-3}	**<0,001**	>0,05
Profile 3	29,24±7,70	p_{2-3}	>0,05	25,46±4,56	p_{2-3}	**<0,05**	>0,05
Type 1	21,23±5,80	p_{1-2}	>0,05	20,22±4,94	p_{1-2}	>0,05	>0,05
Type 2	23,17±8,34	p_{1-3}	**<0,01**	21,79±5,62	p_{1-3}	**<0,05**	>0,05
Type 3	27,33±5,71	p_{2-3}	**<0,05**	23,21±4,72	p_{2-3}	>0,05	**<0,05**

Cont... **Table 2. Teleroentgenographic parameters of soft tissues of the face by the method of Schwarz A.M. in YM and YW with different profiles, or with different face types.**

GI'LsPog' (°)							
Profile 1	157,9±5,8	p_{1-2}	**<0,05**	160,8±4,4	p_{1-2}	**<0,01**	**<0,05**
Profile 2	162,9±4,5	p_{1-3}	**<0,001**	165,7±4,5	p_{1-3}	**<0,001**	>0,05
Profile 3	167,4±5,4	p_{2-3}	**<0,05**	169,3±6,1	p_{2-3}	**<0,05**	>0,05
Type 1	163,8±7,2	p_{1-2}	>0,05	166,0±6,1	p_{1-2}	>0,05	>0,05
Type 2	161,8±7,1	p_{1-3}	>0,05	166,2±6,3	p_{1-3}	**<0,05**	**=0,060**
Type 3	161,2±6,5	p_{2-3}	>0,05	161,8±5,5	p_{2-3}	**<0,05**	>0,05
SnPog'-Pn (°)							
Profile 1	11,26±4,52	p_{1-2}	**<0,01**	9,027±2,930	p_{1-2}	**<0,001**	**=0,068**
Profile 2	6,000±2,646	p_{1-3}	**<0,001**	5,933±2,282	p_{1-3}	**<0,001**	>0,05
Profile 3	4,235±2,611	p_{2-3}	>0,05	3,250±2,541	p_{2-3}	**<0,01**	>0,05
Type 1	8,923±5,204	p_{1-2}	>0,05	6,435±3,369	p_{1-2}	>0,05	>0,05
Type 2	8,333±5,841	p_{1-3}	>0,05	6,625±4,116	p_{1-3}	>0,05	>0,05
Type 3	6,611±3,292	p_{2-3}	>0,05	6,690±3,704	p_{2-3}	>0,05	>0,05
Li-SnPog' (мм)							
Profile 1	2,391±1,803	p_{1-2}	>0,05	2,568±1,923	p_{1-2}	**<0,01**	>0,05
Profile 2	1,889±1,691	p_{1-3}	>0,05	0,933±1,534	p_{1-3}	**<0,05**	>0,05
Profile 3	1,529±1,908	p_{2-3}	>0,05	1,125±2,007	p_{2-3}	>0,05	>0,05
Type 1	1,846±2,154	p_{1-2}	>0,05	1,783±2,315	p_{1-2}	>0,05	>0,05
Type 2	1,889±1,641	p_{1-3}	>0,05	1,458±2,000	p_{1-3}	>0,05	>0,05
Type 3	2,222±1,833	p_{2-3}	>0,05	2,069±1,771	p_{2-3}	>0,05	>0,05

The Pog'-Por distance is greater in YM 2PF and 3PF than in YM 1PF ($p<0.05$ and $p<0.01$, respectively); and in YM 3TF is greater than in YM 1TF and 2TF (respectively, $p<0.01$ and $p<0.05$) (see Table 2). This figure is higher in YW 2PF and 3PF than in YW 1PF (respectively, $p<0.01$ and $p<0.001$), and in YW 3PF – higher than in YW 2PF ($p<0.05$); also, the Pog'-Por distance in YW 3TF is greater than in YW 1TF ($p<0.05$) (see Table 2). Pog'-Por distance was higher in YM 3TF than in YW 3TF ($p<0.05$) (see Table 2).

GI'LsPog' angle values were found to be higher in YM 3PF than in YM 2PF ($p<0.05$) and 1PF ($p<0.001$) and in YM 2PF than in YM 1PF ($p<0.05$) (see Table 2). YW 3PF have a greater GI'LsPog' angle than YW 2PF ($p<0.05$) and 1PF ($p<0.001$); and in YW 2PF – than in YW 1PF ($p<0,01$); the value of this indicator in YW 1TF and 2TF is greater than in YW 3TF ($p<0.05$ in both cases) (see Table 2). GI'LsPog' angle values were found to be higher in YW 1PF than in

YM 1PF ($p<0.05$) and the tendency to a higher value of this indicator was found in YW 2TF than in YM 2TF ($p=0.060$) (see Table 2).

The SnPog'-Pn angle in YM 1PF is greater than in YM 2PF and 3PF ($p<0.01$ and $p<0.001$, respectively) (see Table 2). In YW with different facial profiles, the SnPog'-Pn angle is greater in individuals with 1PF than in YW with 2PF and 3PF ($p<0.001$ in both cases) and greater in YW with 2PF than in YW 3PF ($p<0.01$) (see Table 2). There was also a tendency for higher values of the SnPog'-Pn angle ($p=0.068$) in YM 1PF, compared with YW 1PF (see Table 2).

The Li-SnPog' distance is only greater in YW 1PF than in YW 2PF ($p<0.01$) and 3PF ($p<0.05$) (see Table 2).

Discussion

Numerous author's methods of cephalometric analysis of teleroentgenograms are used in different countries of the world, the most common and recognized of which are the methods of Steiner, Harvold, Tweed's, McNamara, Schwarz, Ricketts, Bjork, Jaraback, Burstone, etc. The urgent need for such an analysis at present is to determine the features of morphometric parameters of the head and its individual structures in certain groups of people. After all, according to numerous researchers, these indicators can differ significantly in people of different sexes, races, ethnicities, ages, populations, geographies of residence, different craniotypes and face types. [3, 4, 11, 17, 20, 21] Taking these features into account will greatly facilitate the identification of the deceased.

As a result of our study, we obtained and analyzed the position of teeth and soft tissue profile of the face in adolescents with different profiles and types of face according to Schwarz, which can usually change, adjust according to normative, appropriate values during the most common dental manipulations in orthodontic and orthopedic practice.

The values of the angles Max1-SpP S-arz and SnPog'-Pn were found to be significantly higher in the YM 1PF than in YM with 2PF and 3PF; and in YW 1PF, the values of the SnPog'-Pn angle and the Li-SnPog' distance are significantly larger than in the YW 2PF and 3PF.

YM 2PF had significantly higher values of Pog'-Por distance and GI'LsPog' angle than YM 1PF; and YW 2PF had significantly greater Pog'-Por and GI'LsPog' angles than YW 1PF and SnPog'-Pn angle than YW 3PF.

YM 3PF had significantly higher Pog'-Por and GI'LsPog' values than YM 1PF and GI'LsPog' angle than YM 2PF; and YW 3PF have significantly higher values: Mand1-MP Shwars, II and GI'LsPog' angles than YW 1PF; GI'LsPog' angle than YW 2PF and Pog'-Por distance than YW 1PF and 2PF.

YM 1TF had significantly higher values of Mand1-MP Shwars and II angles than YM 2TF and angles Max1-SpP S-arz and Mand1-MP Shwars than YM 3TF; and YW 1TF had significantly higher GI'LsPog' values than YW 3TF.

YM 2TF had significantly higher values of Max1-SpP S-arz and II angles than YM 3TF; and YW 2TF had significantly higher GI'LsPog' angle values and a tendency to have a higher Mand1-MP Shwars angle value than YW 3TF.

YM 3TF had significantly higher values of Sn-Pn distance and Pog'-Por distance than YM 1TF and Pog'-Por distance than YM 2TF; and YW 3TF had significantly higher Sn-Pn and Pog'-Por distances than YW 1TF and Sn-Pn distances than YW 2TF.

Almost all researchers from different countries note the presence of sex differences in both cephalometric and gnatometric teleroentgenography indicators, which are usually greater in males, which can be explained by usually higher values in males as anthropometric indicators of the body in general and head size in particular. [6, 12, 13, 22]. At the same

time, no significant sex differences in cephalometric parameters were found in Jordanians. [10]

In our study, we found pronounced signs of sexual dimorphism in certain gnatometric parameters – mostly higher values in YM than in YW of the same profile or the same face type.

It should be noted that all differences between YM and YW with the same facial profiles are set for people 1PF. Thus, YM 1PF have significantly higher values of Sn-Pn distance and a tendency to greater values of angles II and SnPog'-Pn. Instead, YW 1PF have a significantly larger GI'LsPog' angle.

There are many differences between YM and YW with the same face types. YM 1TF have significantly higher values of the angle Max1-SpP S-arz and angle II, YM 2TF – significantly greater values of the distance Sn-Pn, and YM 3TF – significantly greater distance Pog'-Por and the tendency to greater value of the distance Sn-Pn; YW 2TF tend to have a larger GI'LsPog' angle.

Thus, we established and determined the differences of teleroentgenographic indicators of the position of teeth and characteristics of soft tissues of the face in YM and YW of Ukraine with orthognathic occlusion depending on the profile and type of face by the method of Schwarz and revealed pronounced manifestations of sexual dimorphism between adolescents with different profiles and types (more pronounced) of the face according to Schwarz.

Conclusions

The obtained results prove the need to take into account not only age but also sex, type and profile of the face for an individualized approach in determining normative teleroentgenographic indicators of man, which is important in forensic medicine to improve the identification of persons and in practical dentistry to assess the dental apparatus and aesthetic results of interventions in orthopedic and orthodontic dentistry.

Ethical Clearance: Ethical clearance was obtained from the 'Ethics Committee' of the Institution prior to the start of the study.

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Conflict of Interest: No

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