Skull Growth Type Influence on Eastern Europeans' Normal Face Configuration

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Abstract

The face configuration depends on a large factors number: race, gender, innate characteristics, ethnic group. Face structure features systematization showed that skull growth types has a great influence on the face formation. 726 facial soft tissue parameters were assessed of 33 volunteers with normal occlusion at the age 17 - 25 years. After that there were determined normal values of the parameters. A comparative characteristic of the face configuration with different growth types showed their structure patterns and deduced the most stable and changing parameters.

Keywords: *Photometric Analysis; Face Soft Tissue Parameters; Facial Skeleton Growth Types*

Introduction

Modern orthodontics has a large number of special diagnostic methods that allow assessing the dentition function, the morphometric skull parameters, occlusal contacts, and the periodontal state [1]. However, it is impossible to overestimate the importance of clinical diagnostic methods. Assessment and prediction of facial soft tissue configuration during orthodontic treatment contribute to accurate diagnosis and patient-satisfactory results [2,3]. For example: the incisors tilt affects the patient's lips position, but it is difficult for an individual orthodontist to get assess the aesthetic component of such changes due to the subjectivity of the concept of "beauty", ethnic, individual preferences and the lack of norms for comparison [4,5]. Often occurs, that only a visual face assessment and photometric study will give an accurate data of configuration changes. So, Hockley A, Weinstein V, Borislow AJ, Braitman LE [6] compared inhabitants' reaction on patients photographs in profile and the profile outline according to same patients' LCR. The authors obtained very different results, reflecting the clinical methods importance for predicting treatment outcomes and successful communication with patients.

The face configuration depends on a large number of factors: race, gender, congenital characteristics, ethnic group [7]. Face structure features systematization showed that skull growth types has a great influence on the face formation [8]. AA Korobkeev and co-author [9] all three growth types were identified in persons with normal occlusion (neutral - 61.99%, horizontal - 30.48%, vertical - 7.53%), which indicates the variability of skull structure not only with dentition anomalies, but also with normal occlusion.

Purpose of the Study

The study purpose is the face configuration features assessment depending on the facial skull growth type.

Materials and Methods

33 volunteers with normal occlusion aged 17 - 25 participated in the survey. All examined patients had no history of congenital or acquired maxillofacial deformities, orthodontic and/or surgical treatment. There were 12 males, 21 females in the survey. They were divided into three groups depending on the facial growth type: group N - neutral, group G - horizontal, group C - vertical.

The examination included clinical, photometric and radiological research methods. The anamnesis, facial configuration and the presence of dentoalveolar anomalies were studied during a clinical examination (Picture 1).

A

B

C

D

E

F

G

Picture 1: *Normal occlusion clinical signs. A- facial deformities absence in the front, B- in profile, C- the correct closure of the dentition on the right, D- in the anterior section, E- on the left, F- the absence of dentoalveolar anomalies (upper dentition), G- lower dentition.*

Photometric diagnostics was carried out with a professional camera "Canon 6D Mark II" in front and profile. Lens performance has been tested for optical aberrations. No optical aberrations were found. We used a photostat proposed by L.S. Persin for photography (2012) [10] (Picture 2).


A

B

Picture 2: *Facial photometry technique. A- frontal photo, B- profile photo.*

We used the method for assessing the face aesthetics for a photometric survey, proposed by D.B. Kaplan [11].
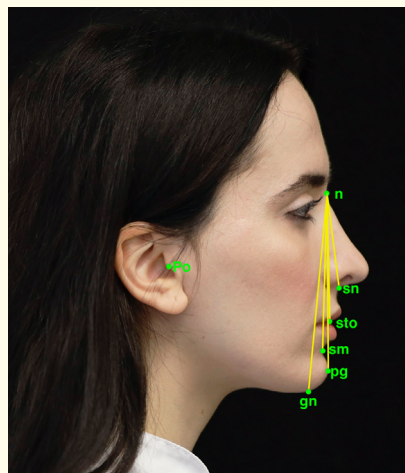
Face points:

- n - The deepest point of the nose bridge

- gn - Point on the chin at the intersection of the medial-sagittal plane

- pg - The most protruding point of the chin

- sn - Nasal septum and upper lip intersection

- sm - Chin crease deepest point

- sto - Upper and lower lips contact point
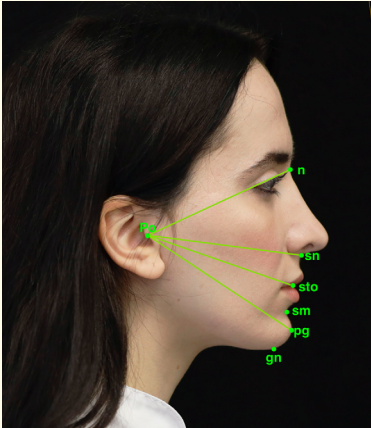
- po - External auditory meatus top point.

There were determined next parameters: n-gn, n-pg, n-sn, n-sm, n-sto, po-n, po-sn, po-sto, po-pg, po-sm, < n-po-sn, < n-po-sm, < n-po--pg, n-pg/n-sn, n-pg/n-sto, n-pg/n-sm, po(L)-po(R)/po- n, po-n/po-sn, po-n/po-sto, po-n/po-pg, po-n/po-sm (Picture 3).
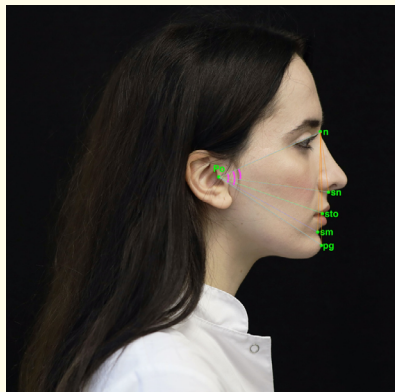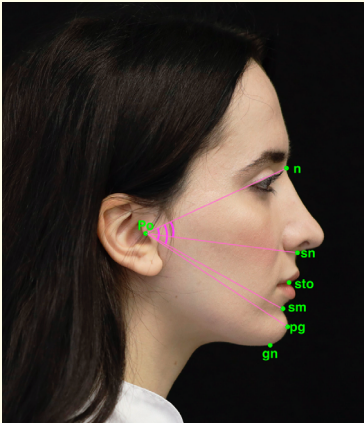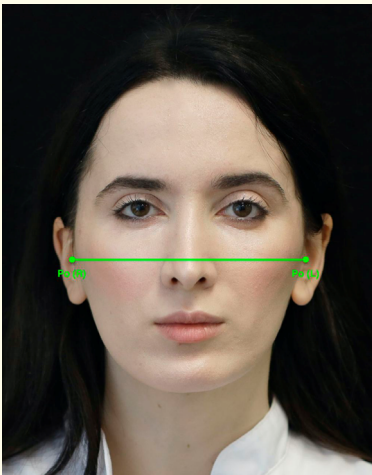

A

B

C

D

E

Picture 3: *Soft tissue photometric points and face parameters localizations. A- facial parameters, B- linear parameters of the height of the face, C- depth of the face, D- angular parameters, E- full face parameters.*

CBCT data were obtained at the CC MPS and Dentistry (clinical center of maxillofacial, plastic surgery and dentistry) of the Federal State Budgetary Educational Institution of Higher Education MSUMD named after. A.I. Evdokimov of the Ministry of Health of the Russian Federation, at the Department of Radiation Diagnostics. Radiation research methods included computed skull tomography.

The resulting DICOM files were processed in ICATVision program. There were used LCR reconstruction from CBCT via "Window of cephalometric analysis" and "Create report" function. The Bjork, NseAr, SeArGo, ArGoMe angels were used to determine growth type (Picture 4).
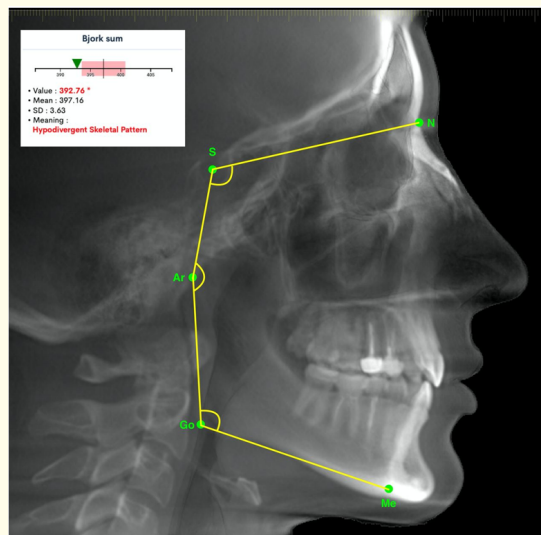
Picture 4: *Bjork angle determination.*

The Bjork angle value from 393 to 399 degrees corresponded to the neutral facial growth type, the value less than 393 degrees corresponded to the horizontal type, the value greater than 399 degrees corresponded to the vertical type.

Research Results and Discussion

There were obtained facial soft tissue normal value parameters (Table 1).

Parameters	Arithmetic mean	Standard error	Standard deviation	Coefficient of variation
Bjork sum	387,68	0,76	4,39	1,13
n-gn	116,58	1,13	6,51	5,58
n-pg	104,38	1,12	6,43	6,16
n-sn	51,86	0,61	3,49	6,73
n-sm	51,86	0,61	3,49	6,73
n-sto	72,92	0,69	3,98	5,46
Po-n	98,22	0,89	5,13	5,23
Po-sn	101,36	0,85	4,87	4,80

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Po-sto	102,69	0,98	5,65	5,50
Po-Pg	116,54	1,33	7,63	6,55
Po-sm	106,66	1,06	6,12	5,73
<n-Po-sn	30,04	0,32	1,83	6,10
<n-Po-sm	51,72	0,46	2,65	5,13
<n-Po-Pg	57,38	0,50	2,88	5,02
n-Pg/n-sn	2,02	0,02	0,11	5,36
n-Pg/n-sto	1,42	0,01	0,05	3,52
n-Pg/n-sm	1,18	0,01	0,04	3,31
Po(L)-Po(R)/Po-n	1,53	0,02	0,09	5,80
Po-n/Po-sn	0,97	0,01	0,05	4,65
Po-n/Po-sto	0,96	0,01	0,06	5,86
Po-n/Po-Pg	0,83	0,01	0,05	5,74
Po-n/Po-sm	0,92	0,01	0,05	5,26

Table 1: Facial soft tissue normal value parameters.

Neutral type of skeletal growth was observed in 27% of the examined, the horizontal type - in 73%, the vertical type was not noted.

In a comparative facial soft tissue parameters analysis, it was determined that linear (n-gn, n-pg, n-sn, n-sm, n-sto) and angular (< n-po-sn, < n-po-sm, < n -po-pg) indicators of face heights are higher in those surveyed with a neutral growth type than with a horizontal one (Picture 5). The face depth parameters (po-n, po-sn, po-sto, po-pg, po-sm) have lower values in a neutral growth type (Picture 6 and table 2, 3).
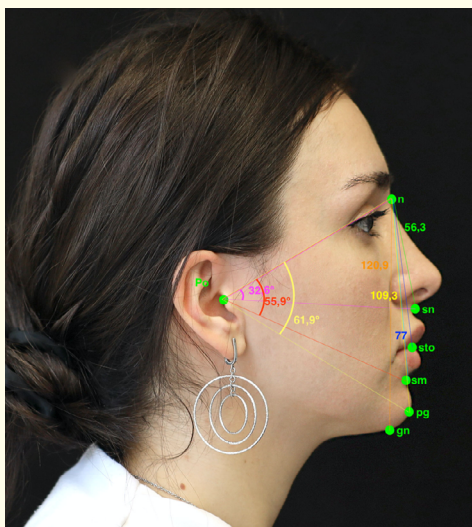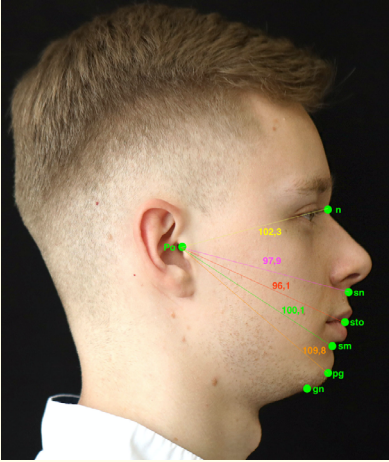

A
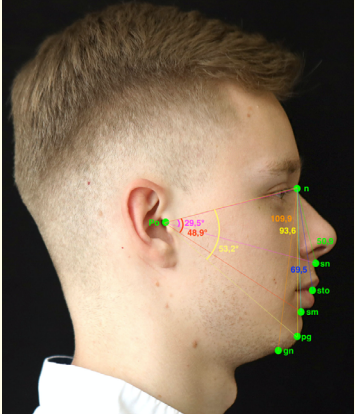
B

Picture 5: *Indices of facial heights in volunteers with neutral and horizontal facial growth. A- neutral growth type, B- horizontal.*

A

B

Picture 6: *Indices of volunteers' faces depth with neutral and horizontal facial growth. A- neutral growth type, B- horizontal.*

| Parameters	Neutral growth type	Standard error	Standard deviation	Standard deviation
Bjork sum	392,91	0,34	1,02	0,26
n-gn	119,17	2,15	6,44	5,41
n-pg	106,88	2,00	6,00	5,61
n-sn	53,48	0,85	2,56	4,79
n-sm	53,48	0,85	2,56	4,79
n-sto	74,43	1,02	3,06	4,11
po-n	96,71	1,88	5,65	5,84
po-sn	99,46	1,59	4,77	4,80
po-sto	100,87	1,79	5,38	5,33
po-pg	114,87	2,06	6,19	5,39
po-sm	105,24	1,69	5,08	4,82
<n-po-sn	31,58	0,42	1,27	4,03
<n-po-sm	54,12	0,57	1,70	3,14
<n-po-pg	59,92	0,61	1,82	3,05
n-pg/n-sn	1,99	0,04	0,12	5,87
n-pg/n-sto	1,42	0,01	0,04	3,10
n-pg/n-sm	1,18	0,01	0,04	3,74
po(L)-po(R)/po-n	1,54	0,02	0,05	3,41
po-n/po-sn	0,97	0,02	0,05	5,17
po-n/po-sto	0,97	0,02	0,07	7,31
po-n/po-pg	0,82	0,01	0,04	5,36
po-n/po-sm	0,91	0,01	0,03	3,66

***Table 2:** Soft tissues parameters of the volunteers' faces with normal occlusion and with a neutral facial skeletal growth type.*

Parameters	Horizontal growth type	Standard error	Standard deviation	Coefficient of variation
Bjork sum	385,72	0,70	3,42	0,89
n-gn	115,61	1,30	6,39	5,53
n-pg	103,44	1,32	6,46	6,24
n-sn	51,26	0,74	3,64	7,11
n-sm	51,26	0,74	3,64	7,11
n-sto	72,35	0,86	4,19	5,80
po-n	98,79	1,01	4,93	4,99
po-sn	102,08	0,98	4,81	4,71
po-sto	103,37	1,17	5,71	5,52
po-pg	117,17	1,66	8,13	6,94
po-sm	107,19	1,32	6,48	6,05
<n-po-sn	29,46	0,34	1,68	5,71
<n-po-sm	50,81	0,49	2,38	4,69
<n-po-pg	56,43	0,54	2,63	4,66
n-pg/n-sn	2,03	0,02	0,10	5,16
n-pg/n-sto	1,43	0,01	0,05	3,73
n-pg/n-sm	1,18	0,01	0,04	3,22
po(L)-po(R)/po-n	1,53	0,02	0,10	6,53
po-n/po-sn	0,98	0,01	0,04	4,54
po-n/po-sto	0,95	0,01	0,05	5,33
po-n/po-pg	0,84	0,01	0,05	5,90
po-n/po-sm	0,93	0,01	0,05	5,75

***Table 3:** Volunteers' faces soft tissues parameters with normal occlusion and facial skeleton horizontal growth type.*

In this case, the values of the proportionality indices (n-pg/n-sn, n-pg/n-sto, n-pg/n-sm, po(L)-po(R)/po-n, po-n/po- sn, po-n/po-sto, po-n/po-pg, po-n/po-sm) of face parameters of height and depth remain the same and do not depend on the growth type in the normal dentition occlusion.

Statistically significant differences were determined for the parameters: < n-po-sn, < n-po-sm, < n-po-pg (p < 0.001) (Picture 7).
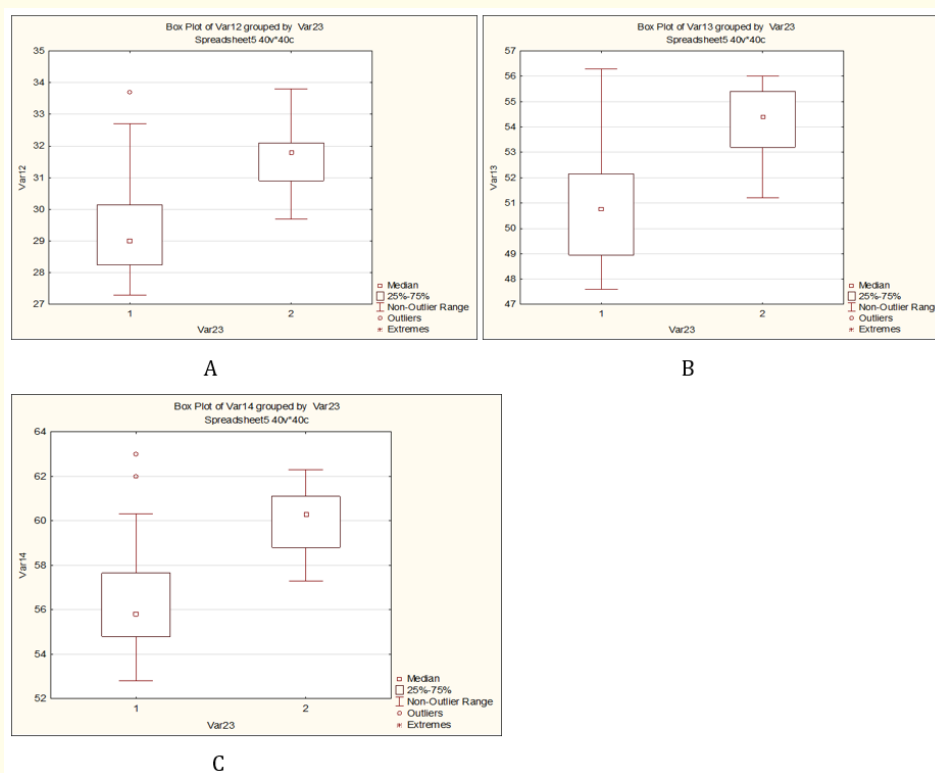
Picture 7: *Significant statistic differences in face soft tissue parameters at neutral and horizontal growth type.*
A- < n-po-sn, B- < n-po-sm, C- < n-po-pg.

Conclusion

1. The structural features assessment of Eastern European faces showed the absence of facial skeleton vertical growth type and the predominance of a horizontal growth type, which gives rise to use special ethnic norms for photometric analysis of patients' faces.

2. The angles characterizing the face heights, are the reference indicators which can be used in express face analysis and the differential diagnosis of dentoalveolar anomalies.

3. The proportionality indices stability of persons with dentition normal occlusion indicates the harmony of the face structure regardless of the facial skeleton's growth type.

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