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SHORT COMMUNICATION

Gender and BMI Differences in Adult Craniofacial Parameters in Caucasian Population: A Pilot Study

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Abstract

Objective: To determine the association between age and selected craniofacial parameters according to the Body Mass Index (BMI) and gender in Caucasian population in central Europe. **Material and Methods:** Data were collected in maxillofacial surgeries in Slovak Republic in period 2013 - 2016. The study sample was divided into younger (≤ 22 years; n = 49) and older sample (> 23 years; n = 55). Patients were analyzed by directed anthropometry and 3D scan. Data were organized using the Statistical Package for Social Sciences (SPSS) software and presented through descriptive and inferential statistics (two-sample T-test and Fisher's exact test). The significance level was 5%. **Results:** In younger and older study sample according to BMI was not found significant effect on evaluation selected craniofacial parameters. In the category BMI > 25.0 [kg.m-2] younger study sample had higher mean values in bi-zygomatic breadth (13.6 ± 2.2 cm vs. 12.9 ± 0.9 cm; p = 0.287) than older study sample, while in older study sample was found higher bi-gonial breadth (11.9 ± 1.4 cm vs. 10.8 ± 0.9 cm; p = 0.169) than younger study sample. Males in age > 23 years had significant distance between two Gonion (bi-gonial breadth) (11.7 ± 1.3 cm) than males in age ≤ 22 years (10.9 ± 1.0 cm). Higher total facial height was found in category males > 23 years (12.5 ± 0.7 cm) in compare with category males ≤ 22 years (12.1 ± 0.5 cm) (p = 0.018). **Conclusion:** The patient age should be considered in analysed of soft tissue proportions (bi-gonial breadth and total facial height).

Keywords: Anthropometry; Cephalometry; Malocclusion; Population Groups.

Introduction

Anthropometry is useful in orthodontic research and in reconstructive surgery [1] – external oral injuries [2,3]. Facial soft tissue thickness is essential to orthodontists, forensic anthropologists and plastic surgeons [4]. The attractive face and smile are key factors for orthodontic patients [5]. For teenagers and adults is physical attractiveness one of the most important factors affecting social relationships [6].

Malocclusions play the important role in the public health [7]. It can affect patients' psychosocial wellbeing [6] and it may have a negative impact on quality of life [8]. The ethnicity, dietary habits, orthodontic care, nutritional status, religious beliefs and age influence on the malocclusion [9]. However, a causal relationship between craniofacial parameters of soft tissue and age has not been convincingly demonstrated. The data on the facial soft tissue of Slovak adults have not been documented.

The aim of this study is determine the association between age and selected craniofacial parameters according to the Body Mass Index and gender in Caucasian population in central Europe.

Material and Methods

Study Design and Sample

In this cross-sectional study, the sample (n=104) was divided into younger (≤ 22 years; n = 49) and older sample (> 23 years; n = 55). Patients were analyzed by directed anthropometry and 3D scan. The selection study criterion was age (18 - 35 years), ethnicity – white Caucasian race, residence in Slovak Republic, no ontogenetic changes and no malocclusion.

Data Collection

Data were collected in maxillofacial surgeries in Slovak Republic in period 2013 – 2016. The analysed craniofacial anthropometric parameters (al – al: nose breadth; en – en: pupils-mid face (right); zy – zy: bi-zygomatic breadth; go – go: bi-gonial breadth; n – gn: total facial height; ch – ch: mouth breadth) used in the study are presented in Table 1.

Table 1. The analysed craniofacial anthropometric parameters used in the study.

Anthropometric Point	Abbreviation	Description the Anthropometric Point	Location of Anthropometric Point in 3D Model
Gnathion in soft tissue	gn	The lowest point in the midline on the lower border of the chin.	1. Define a point on the right side by bony surface profile, verify the position of the left-hand profile 2. Verifying the central position under the base of 3D facial scan.
Gonion in soft tissue	go	The most lateral point at the angle of the mandible.	1. Define a point on the right side and left-side profile. 2. Verifying the position in the front view.
Nasion in soft tissue	n	The midpoint of the nasofrontal suture.	1. Define a point on the right side and left-side profile. 2. Verifying positions in frontal view 3D facial scan.

Zygion in soft tissue	zy	The most lateral point on the zygomatic arch.	1. Define a point on the right side and left-side profile. 2. Verifying the position in the front view.
Alare	al	The most lateral point on the nasal ala.	1. Defining the point of view of 3D facial basal scan.
Cheilion	ch	The outer corner of the mouth where the outer edges of the upper and lower vermilions meet.	1. Defining the point of view of the frontal.
Endocanthion	en	The inner corner of the eye fissure where the eyelids meet.	1. Defining the point of view of the frontal.

Statistical Analysis

Data were organized using the Statistical Package for Social Sciences (SPSS) software and presented through descriptive (mean and standard deviation) and inferential statistics (two-sample T-test and Fisher's exact test). The level of statistical significance was set to 5%.

Results

Mean values of selected craniofacial parameters in younger and older study sample according to BMI and gender are presented in Table 2.

Table 2. Mean values of selected craniofacial parameters in younger and older study sample according to BMI and gender.

Craniofacial Parameters	Category		≤ 22 years (n = 49)		> 23 years (n = 55)		p-value
			n	Mean (SD)	n	Mean (SD)	
al – al nose breadth (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	3.5 ± 0.4	40	3.4 ± 0.3	0.948
		> 25.0	4	3.6 ± 0.4	15	3.7 ± 0.3	0.550
	Gender	Male	21	3.6 ± 0.4	31	3.7 ± 0.3	0.545
		Female	28	3.3 ± 0.3	24	3.2 ± 0.2	0.094
en – en pupils-mid face (right) (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	3.0 ± 0.4	40	3.0 ± 0.4	0.933
		> 25.0	4	3.0 ± 0.3	15	3.1 ± 0.3	0.742
	Gender	Male	21	3.0 ± 0.3	31	3.1 ± 0.4	0.227
		Female	28	3.0 ± 0.4	24	2.9 ± 0.3	0.294
zy – zy bi-zygomatic breadth (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	12.5 ± 2.1	40	12.4 ± 1.1	0.840
		> 25.0	4	13.6 ± 2.2	15	12.9 ± 0.9	0.287
	Gender	Male	21	13.3 ± 1.1	31	13.0 ± 0.9	0.385
		Female	28	12.1 ± 2.5	24	11.7 ± 0.6	0.408
go – go bi-gonial breadth (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	11.0 ± 0.8	40	11.2 ± 0.9	0.414
		> 25.0	4	10.8 ± 0.9	15	11.9 ± 1.4	0.169
	Gender	Male	21	10.9 ± 1.0	31	11.7 ± 1.3	0.017
		Female	28	11.1 ± 0.7	24	11.1 ± 0.6	0.997
n – gn total facial height (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	11.5 ± 0.8	40	11.8 ± 0.7	0.090
		> 25.0	4	12.1 ± 0.3	15	12.6 ± 0.8	0.213
	Gender	Male	21	12.1 ± 0.5	31	12.5 ± 0.7	0.018
		Female	28	11.1 ± 0.7	24	11.5 ± 0.8	0.065
ch – ch mouth breadth (cm)	BMI [kg.m^{-2}]	18.6 – 24.9	45	5.0 ± 0.5	40	5.2 ± 0.4	0.086
		> 25.0	4	5.5 ± 0.4	15	5.4 ± 0.3	0.524
	Gender	Male	21	5.4 ± 0.3	31	5.4 ± 0.3	0.656
		Female	28	4.7 ± 0.4	24	4.9 ± 0.3	0.296

In younger and older study sample according to BMI was not found significant effect on evaluation selected craniofacial parameters. In the category BMI > 25.0 [kg.m^{-2}] younger study sample had higher mean values in bi-zygomatic breadth (13.6 ± 2.2 cm vs. 12.9 ± 0.9 cm; p = 0.287) than older study sample, while in older study sample was found higher bi-gonial breadth (11.9 ± 1.4 cm vs. 10.8 ± 0.9 cm; p = 0.169) than younger study sample.

Males in age > 23 years had significant distance between two Gonion (bi-gonial breadth) (11.7 ± 1.3 cm) than males in age ≤ 22 years (10.9 ± 1.0 cm). Higher total facial height was found in category males > 23 years (12.5 ± 0.7 cm) in compare with category males ≤ 22 years (12.1 ± 0.5 cm) (p = 0.018).

Discussion

In the recent malocclusions studies is not accessible data of optimal facial soft tissue thickness in the white Caucasian population in central Europe. The study consist important benefit for orthodontists, forensic anthropologists and plastic surgeons.

A previous study developed with Chinese adults analyzed 86 anthropologic characteristics [10] and the higher mean value of the nose breadth was found (al – al: females 3.74 cm and males 3.98 cm) than in our study. This can be partly explained by the ethnicity, body mass index and sample size differences.

One of the craniofacial parameters is bi-zygomatic breadth. The anthropometric point is the most lateral point on the zygomatic arch. In our study in males was found higher values in bi-zygomatic breadth than the Nepalese study [11].

In bi-gonial breadth we found an association between gender and BMI rate. In males (>23 y.) were observed higher values in bi-gonial breadth. This can be explained by the fact that in bi-gonial breadth is most often localized the facial fat and the localized facial fat is linearly dependent on age.

Another interesting observation from this study is the difference in total facial height in males between younger (12.1 ± 0.5 cm) and older (12.5 ± 0.7 cm) study sample. The basis for our measurements was Farkas and Deutsch study [12], which realized measurements in humans of the Europoid race. A slightly higher mean value of craniofacial parameters was found in the breadth of the mouth (ch-ch) in women when comparared with previous research [12].

The lower number craniofacial studies for the Caucasian population and the sample size (representativeness) are possible limitations our study.

Conclusion

The knowledge about optimal craniofacial parameters can help orthodontists and plastic surgeons to design dental interventions and an improvement quality of oral health. The values of craniofacial parameters in Slovak population can be used for the comparison of other craniofacial studies. We conclude that the patient age should be considered in analysed of soft tissue proportions (bi-gonial breadth and total facial height).

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