Distribution of the three vertical facial patterns in individuals aged 17-20 years

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Abstract

Aim. Determination of the incidence of different types of vertical facial pattern in Bulgarian individuals aged 17-20 years.

Material and Methods. The study included 110 subjects, 43 male and 67 female. The mean age of the participants was 18.4 ± 6.1 years. Lateral cephalometry was performed to each subject and two angles were measured: M/SN angle (between the mandibular (M) and the SN plane), and M/SpP angle (between mandibular and spinal plane). The subjects were divided into 3 groups according to M/SN angle and M/SpP angle: Hypodivergent, normodivergent and hyperdivergent.

Results. In men according to M/SN angle, the ratio of hypo- to normo- to hyperdivergent was 44.2%: 27.9%: 27.9%, while in women it was 23.9%: 44.8%: 31.3% respectively. According to M/SpP angle in men this ratio was 51.2%: 37.2%: 11.6%, and in women 35.8% : 44.8% :19.4% respectively.

Conclusion. In men prevailed the group of the hypodivergent individuals, while in women, normodivergent facial pattern is the largest group, calculated on both angles.

Key words: incidence of vertical facial pattern, sexual dimorphism

Introduction

Literature data on the distribution of different facial types is comparatively scarce. Normal variations in the vertical direction have led to the definition of three main facial types: hyperdivergent, normo-, and hypodivergent (1). Different authors use different criteria for evaluating the facial type (2, 3,4).

According to some authors, skeletal types are associated with the development of masticatory muscles and their morphological characteristics (5). In experimental studies, it has been established that eating habits (use of softer or harder food) lead to different loads and to different muscle strength of the masticatory apparatus, and hence to differences in the growth of the facial skeleton. Facial type is also considered to depend on race (6).

According to Björk A. (7) and Kohn L. (8), both genetic and exogenous factors are involved in the formation of the hyperdivergent facial type. This is supported by authors who found in twins that vertical craniofacial size (height of the face) is heritable to a significantly greater extent than horizontal (width of the face) (9, 10, 11).

The influence of the masticatory muscles on the vertical dimensions of the facial skeleton has been established in many studies. Individuals with a hyperdivergent type have significantly reduced maximal masticatory force (12, 13, 14) as well as reduced EMG activity of the masticatory muscles compared to individuals with a hypo- or normodivergent facial type (15, 16, 17.). Another finding associated with the hyperdivergent type is the strong muscles responsible for opening the mouth (5). A significant relationship is found also between the masticatory muscle activity and vertical skeletal growth pattern. (18).

Almost the same maximum bite force was found in hyper- and normodivergent facial type in children (19), while in adults the bite force is significantly smaller in the hyperdivergent than in normodivergent ones. In the vertical facial type, the increase of the masticatory force lags during growth and development compared to individuals with normal growth. Because signs of the hyperdivergent type appear before the differences in the masticatory force are present, it can be suggested that lower forces are rather a consequence than a cause of the condition (12).

It is possible that children with a vertical growth type (highly genetically determined) have weaker masticatory muscles due to the skeletal morphology. These children develop secondary adaptive changes in the masticatory apparatus leading to the complete expression of vertical growth signs (20).

Skeletal pattern is important for the orthodontic diagnosis, treatment, and the therapeutic response (21). For example, control of the vertical dimension during orthodontic treatment is of major importance in subjects with hyperdivergence (22).

Because the facial type and its relationship with the masticatory forces are important for the determination of the treatment approaches, it is of interest to study the incidence and distribution of different facial types.

Aim

Determination of the incidence of different types of vertical facial pattern in Bulgarian individuals aged 17-20 years.

Material and methods

The study included 110 subjects, 43 male and 67 female. The mean age of the group was 18.4 ± 6.1 years. The study did not include individuals who underwent or are undergoing orthodontic treatment. The participants of the study were recruited from patients seeking orthodontic treatment and voluntary students from the Faculty of Dental Medicine, Medical University, Sofia. Lateral cephalometry was performed on each subject and two angles were measured: between the mandibular (M) and the SN plane (M/SN angle), and between mandibular and spinal plane (M/SpP angle).

According to M/SN angle and M/SpP angle the subjects were divided into 3 groups : according to M / SN angle: hypodivergent - with less than 29°; normodivergent - angle between 29° and 35 °; hyperdivergent - more than 35°. According to M/SpP angle the groups were as follows: hypodivergent - with less than 22°; normodivergent - angle between 22° and 28°; hyperdivergent - more than 28°. The angles between the aforementioned planes were read to the nearest 0.5°.

Statistical methods

The statistical analysis was performed using IBM SPSS 23.0 statistical package. For a significance level at which the null hypothesis is rejected, p<0.05 was assumed.
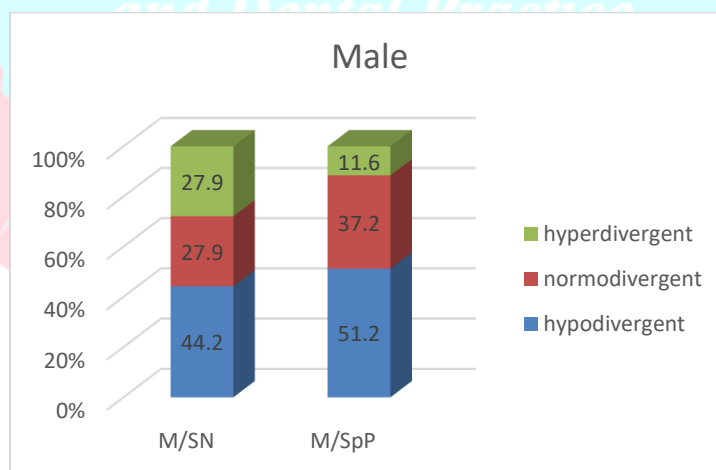
Results

On table 1 is shown the frequency of distribution of patients by gender and groups. The results show that regardless of the angle (M/SN or M/SpP), according to which the facial pattern is determined as hypo-, normo- or hyperdivergent, in women predominates the normodivergent type, and in men at both angles (M/SN and M/SpP) the relative proportion of hypodivergent individuals is the largest (Figs. 18 and 19). However, from the presented data it can be seen, that there is no significant difference between the frequency distribution of the two genders in the studied groups, separated both according to angles M/SN (P>0.05) and M/SpP (P>0.05).
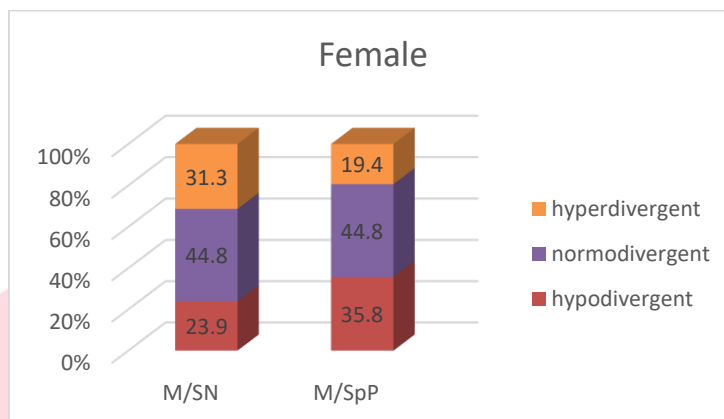
Table 1: Distribution of the facial type of the subjects by gender and groups

Variable	Male (n=43)		Female (n=67)		P
	n	%	n	%	
Groups according to M/SN					0,066
Hypodivergent	19	44,2	16	23,9	
Normodivergent	12	27,9	30	44,8	
Hyperdivergent	12	27,9	21	31,3	
Groups according to M/SpP					0,247
Hypodivergent	22	51,2	24	35,8	
Normodivergent	16	37,2	30	44,8	
Hyperdivergent	5	11,6	13	19,4	

On Figures 1 and 2 is presented the frequency of distribution of the three facial patterns divided by gender and angles.

Figure 1. Distribution of the facial pattern in men according to angle M/SN and angle M/SpP

Figure 2. Distribution of the facial pattern in women according to angle M/SN and angle M/SpP

Discussion

Our data show that the distribution of the facial patterns in men and women changes depending on the angle by which the facial pattern is defined. When evaluated according to the M/SpP angle compared with the M/SN angle, the group of the hyperdivergent decreases, and the group of the hypodivergent increases both in males and females, which means that part of the hyperdivergent merge to the group of normodivergent subjects. The same is observed with the hypodivergent individuals – the group increases because part of the normodivergent pass to it. It is also observed that in women in both cases the percentage of normodivergent remains almost unchanged, while in men the group of normodivergent increases, determined according to the M/SpP angle.

The results also point that regardless of the angle according to which the patients' group is determined, the normodivergent facial type prevails in women in both angles. In women, when classified according to M/SN, second is the hyperdivergent pattern, and when classified according to M/SpP, second is the hypodivergent group. In men, when classified according to both angles, the relative share of hypodivergent individuals is the largest.

Alarcón, J.A. et al. (2), who studied 187 Europeans, (92 men and 95 women), found that the ratio of hypo- to normo- to hyperdivergent in total was 41:97:49, classified according to FMA. This ratio in men is 21:46:26, and in women, it is 20:51:23, respectively.

As to women, our data match those of Alarcón J.A. et al. (2), but in men, our study shows prevalence of the hypodivergent type, while Alarcon JA (2) found that the normodivergent facial pattern is the most common facial pattern in men.

Siriwat PP and Jarabak JR (4) using Jarabak's facial height index (FHI) determined the facial type in 500 randomly selected individuals aged 8-12 years. Of them hyperdivergent were 10%, normodivergent 46% and hypodivergent 44%. Cardoso et al. (23) in a study including 5020 Brazilians with mean age 13 years report 14.06% of hyperdivergent individuals.

We found that in women, the largest is the normodivergent group (44.8 %), classified according to both angles - M/SN and M/SpP. In women, according to M/SN, second are hyperdivergent individuals (31.3%), and according to M/SpP - in the second place are hypodivergent individuals (35.8%).

In men, when distributed according to the two angles, the relative share of hypodivergent persons is the largest. Normodivergent cases compared to M/SN are equal in number to hyperdivergent cases (27.9%), while compared to M/SpP - normodivergent cases are 37.2% and hyperdivergent cases are 11.6%.

In a group of 54 men with completed growth and no temporomandibular joint complaints, Van Spronsen (20) found that the ratio of hyperdivergent: normodivergent : hypodivergent is 14:31:9. By means of nuclear magnetic resonance, he found that in the hypodivergent individuals the cross-section of the m. masseter and m. pterygoideus medialis are approximately twice as large as in hyperdivergent individuals and the temporalis muscle was found to be 30% larger in cross section compared to hyperdivergent individuals. (19) Studies on the relationship between maximum occlusal force and various parameters from lateral cephalometry show that maximum masticatory force is greater at lower values of the angle between the mandibular and spinal planes. This supports the accepted opinion that people with a hypodivergent type have higher masticatory force values (24). Our studies on the masticatory force did not show significant difference of the maximal values between hypodivergent and normodivergent individuals on both the left and right sides. Masticatory force in our previous studies in hyperdivergent patients showed significantly lower values compared to hypo- and normodivergent (according to M/SN angle) as well as hypodivergent (according to M/SpP angle) (25). Compared to M/SN angle, the differentiation of the hyperdivergent individuals is more precise, i.e. the SN plane is more indicative of the classification. When the maximal occlusal force is compared with various parameters from the lateral cephalometry analysis, maximal masticatory force was found to be greater at lower values of the angle between the mandibular and spinal planes, supporting the concept that individuals with the hypodivergent type have bigger maximum occlusal force values (24).

The differences of the facial type distribution depending on the angle used can be explained as follows: M/SN is an angle that is formed by a skeletal parameter – line SN. It is shown to be more invariant, while M/SpP is an angle that uses the spinal plane which is susceptible to changes related to malocclusions and orthodontic treatment.

Conclusion

In our study, we found that the normodivergent facial type prevailed in women, while the hypodivergent type of growth prevailed in men. The distribution of vertical facial types showed differences depending on the angle at which it is determined. We consider that the M/SN angle better differentiates hyper- from normodivergent subjects. The lower masticatory force in hyperdivergents suggests avoiding or very cautiously using appliances in cases of a pronounced vertical component of force, as the masticatory force is not effectively opposed.

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