Craniofacial Variations in a South Dalmatian Population

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Summary

The aim of the investigation was to determine the mean values of selected craniofacial and gnathometric parameters and to evaluate the distribution of basic craniofacial types and subjects from the south Dalmatian region. The object was to record eventual variations on the basis of comparison with a comparable sample from north Croatia. The investigation was carried out on 100 subjects of both sexes, aged between 18 and 30 years from the south Dalmatian region. The findings for 200 homologous subjects according to sex and age from north Croatia were used for comparison of results. Customary anthropometric procedure was used to measure twelve variables, on the basis of which indexes for the head, face, forehead and palate were calculated.

In the examined population, the results showed that according to the head index values mesocephalia predominated, and for the facial index leptoprosopia, while in the north Croatian population, brachycephalia and euriprosopia were most common. The mean value for the head index indicated a lower, wider forehead, and according to palate height index, a high palate was predominate in the subjects from the south Dalmatian region.

Key words: craniofacial indexes, gnathometrics.

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Introduction

The shape of the head and face depend on many factors, such as racial and ethnical affiliation, climate, surroundings, socio-economic, nutritional and genetic influences. In cephalometric studies numerous modern electronic methods are applied (1,2,3), from early childhood to adulthood, and also conventional anthropometric techniques (4,5). Investigations of variations in basic craniofacial parameters between different ethnic groups, or the influence of factors from the surroundings, are still relevant, judged by the numerous studies performed (6-14). Differences were found according to age and sex, which were also found in an investigation by Gaži-Čoklice and co-workers in our population

(15,16). As early as the beginning of the 20th century correlation was observed between some craniofacial parameters and basic jaw dimensions, which is significant with regard to assessment of overall craniofacial morphology and diagnostics of orthodontic anomalies.

In view of the aforementioned different factors, which participate in the formation of a phenotype, it can be assumed that there are also differences between populations of the same ethnic group, particularly under the influence of migration trends, effects of climate and surroundings. In the course of history the population of south Croatia underwent significant migration changes, during which the autochthonous population integrated with the new settlers from the eastern regions of the Neretva valley, particularly in the 15th century. Furthermore, to a certain extent the population of south Croatia was exposed to migrations from northern areas during the period of the Austrian administrative and political rule in the 19th century and in the first two decades of the 20th century.

The inhabitants of Dubrovnik integrated with new settlers from the surrounding islands. The present population structure consists of slightly less than one third of the population originating from regions east of Dubrovnik, Župa and Konavle. The share of the population from the coastal belt west of Dubrovnik amounts to 20%. Five per cent of the population originated from the area of Pelješac, Imotski, the Neretva region and central Dalmatian islands. Approximately one fifth of the population consists of settlers from the Bosnian regions and other regions, which gravitate to this area (17).

With regard to the present population structure, dominated by the autochthonous population, geographic position and Mediterranean climate, it is assumed that significant craniofacial variations exist within the population sample of the Dubrovnik region, namely south Croatia.

Consequently, this investigation was undertaken in order to determine the mean values of selected craniofacial and gnathometric parameters and to indicate possible differences with regard to sex, calculate the frequency of head and face forms in relation to index values and to show the variations by which the examined population differs from a control group from northern areas of Croatia.

Subjects and methods

The sample consisted of 100 subjects, 47 male and 53 female, aged from 18 to 30 years, from the Dubrovnik area and wider surroundings. The control sample consisted of the results of measuring a sample of 200 subjects, 100 male and 100 female, from areas in north Croatia. Measurements of basic craniofacial parameters were taken directly on the subjects by standard anthropometric instruments, a cephalometer and a slide rule, defined by cephalometric points according to Martin and Saler (18).

G-OP   (glabela-opistokranion)
EU-EU (eurion-eurion)
ZY-ZY (zigion-zigion)
Ft-Ft   (frontotemporale-frontotemporale)
Go-Go (gonion-gonion)
N-Gn   (nazion-gnation)
N-Pr   (nazion-prostion)
Tr-N   (trihion-nazion)

On the basis of basic measurement data, head, face and forehead indexes were calculated according to the formulae:

IG = Eu-Eu x 100 / G-Op
IL = N-Gn x 100 / Zy-Zy
IF = Tr-N x 100 / Ft-Ft

The following values were applied for distribution of particular craniofacial types:

HEAD INDEX	M	F
Dolichocephalia	71.0 - 75.9	72.0 - 76.9
Mesocephalia	76.0 - 80.9	77.0 - 81.9
Brachycephalia	81.0 - 85.4	82.0 - 86.4
FACE INDEX	M	F
Euriprosopia	79.0 - 83.9	77.0 - 80.9
Esoprosopia	4.0 - 87.9	81.0 - 84.9
Leptoprosopia	88.0 - 92.9	85.0 - 89.9

Impressions of the upper and lower jaw were taken of subjects from the south Dalmatian region, casts were made and the following gnathometric variables measured by means of a basic orthodontic instrument, i.e. a three-dimensional calliper, according to Korkhaus:

Pgš (anterior upper width of dental arch)
Sgš (posterior upper width of dental arch)
Pgd (anterior upper length of dental arch)
Vn (palate height)

By inclusion in the formula: IVN = Vn x 100/Sgš the palate was classified as shallow when the index was less than 27.9; medium when the index was between 28.0 and 39.9, and high when the index exceeded 40.0.

All data were analysed according to basic statistic parameters, i.e. range, arithmetic mean and standard deviation. Student's test was used to interpret the differences in arithmetic means of all the variables of the two samples. Relative frequencies of the basic form of head and face in subjects from the south Dalmatian region were calculated. Correction analysis, presented by means of the height of the correlation coefficients, was applied on the overall sample of subjects from the south Dalmatian region.

Results

The findings of basic statistic parameters for craniofacial data in subjects from the south Dalmation region, are shown in Table 1. Data are presented on range, arithmetic means and variability for the autochthonic craniofacial variables, and craniofacial indexes for the whole sample and separately according to sex. Table 2 shows mean values of craniofacial variables for both samples and the significance of their differences. Distribution of basic craniofacial types within the sample of subjects from the south Dalmatian region, according to the head and face index, is shown in Tables 3 and 4. Table 5 shows the basic statistic parameters of gnathometric variables and palate index, and Table 6 indicates the values of Pearson's coefficients and intensity of correlations between the examined variables of the total sample from the south Dalmatian region.

Discussion

Dimensions of all the examined craniofacial variables (Table 1) were considerably greater in the male subjects, which was demonstrated by testing the differences of arithmetic means according to sex. Such proportional differences did not influence the height of the indexes of the head, face and forehead, where no statistically significant differ-

ence in mean values was found. Mean values of gnathometric variables differed insignificantly according to sex, although neither were statistically significant. In the examined sample from south-Dalmatia the length of the head, measured by means of the variable G-Op (glabela-epistocranion), amounted to an average of 191.2 mm for males and 182.6 mm for females. No statistically significant difference in arithmetic means was registered between the examined sample and the sample from the central Coatian region (Table 2). This variable showed significant correlation with the variable Eu - Eu (eurion-eurion), where correlation coefficient was 0.50, indicating that increased sagittal dimension of the head is correlated with increased width of the head. In the same way it is possible to explain the correlation of bigobnial range, variable Go-Go (gonion-gonion) where the correlation coefficient was 0.40, with the height of the face N-Pr (nazion-prostion) and the width of the face Zy-Zy (zigion-zigion). The significant negative correlation with the variable IG (index of the head) indicates that the length of the head is a more significant parameter in determination of cephalic type (Table 6).

The mean value of the Eu-Eu (eurion-eurion) variable, which defines the maximum width of the head, amounted to 153.6 in males and 147.7 in females from the south Dalmation region, which are statistically significantly lower values that those recorded in subjects from central Croatia. The maximum width of the head is in significant correlation with the width of the forehead Ft-Ft (r = .48) width of the face Zy-Zy (r = .48) and the height of the face (r = .48). Correlation with the variable IL (index of the face) is logical because of mathematical dependence within the formula for calculation of facial type. Considerable correlation was recorded between the width of the head, width of the face and lower jaw by Gaži - Čoklica (19) on a sample of Croatian subjects and Solow (20) in Scandinavians.

Recorded mean values for the variable Zy-Zy (zigion - zigion), which determines the width of face, in subjects from the south Dalmatian region, amounted to 128.5 for males and l24.1 for females, which are statistically significantly lower values in relation to the mean values of this variable in the subjects from central Croatia. Correlation of face width with head width was also significant, and with

the variables Tr-N (trihion-nazion), N-Pr (nazion-prostion), by which the face height is defined, and with the variable Go-Go (gonion-gonion), where the correlation coefficient was slightly lower. True correlation was also noticed with the gnathometric variables Pgš (anterior upper width), Sšg (posterior upper width) and Pgd (anterior upper length). Gaži Čoklica (19) also found correlation between the variables that define the width of the face and posterior width of the jaw. Šimunović (21) recorded correlation between variables Zy-Zy and variables N-Gn, G-Op and N-Pr.

Arithmetic mean for variables Go-Go (gonion-gonion) was 109.1 mm for males and 105.9 mm for females. Very similar values were also found within the sample from central Croatia, which are also not statistically significant. This finding is in agreement with the results of Gaži-Čoklica (19), while the mean value found by Butković-Šober (22) was slightly lower, which can be explained by the younger age of her subjects. The variable Go-Go showed correlation with the length of the head and width of the face and mandibula, low correlation with total (N-Gn) and mean height of the face (N-Pr).

Mean values of the variables, which indicate the face height N-Gn (nazion-gnation) and N-Pr (nazion-prostion) were statistically significantly greater in subjects from the south Dalmatian region than the values of the same variables in subjects from central Croatia. Together with the differences recorded for the width of the head and face, this shows the significant phenotype differences of both populations. Apart from the aforementioned correlation, the variable N-Gn points to a high correlation with the variable N-Pr, which is of a topographic character, and with the variables Go-Go and Tr-N. Correlation of face height with the height of the palate (VN) was also observed, and in this connection with the index of palate height (IVN).

Arithmetic mean of the variable Ft-Ft, which signifies the width of the forehead, in the population of south Dalmatian subjects, amounted to 123.34 for males and 116.56 females, which differs significantly from the values of the same parameter in subjects from the central Croatian region. The width of the forehead is highly correlated with the width of head, as already mentioned, and with the face (r= .63), which is logical as both variables signify

the width of the upper part of head. The width of the forehead is also slightly less correlated with the height of the forehead and the total height of the face. The height of the forehead, examined on the basis of the variable N-Tr, is significantly higher in subjects of both sexes from the south Dalmatian region.

According to the size of the mean value of the variable IG, which amounted in total to 80.81 in subjects from the south Dalmatian region (with negligible differences according to sex) it can be concluded that mesocephalia was predominant in the examined sample, compared to the mean value of the same variable in subjects from central Croatia, where brachycephalia prevailed. When relative frequencies are analysed mesocephalia (48.0%) and brachycephalis (42.0%) were predominant in the examined sample and dolichocephalia (10%) least frequent. These findings differ from the findings which are valid for subjects from central Croatia, where brachycephalia was predominant (X = 82.26). Significantly higher values for the head index and consequent dominance of brachycephalia in areas of central Croatia, were recorded by Cipruš (23) and Dukić-Homanova (24). Very significant differences were found in the form of the face between both categories of subjects. In the south Croatian region, according to the size of IL - face index - (X = 93.37) leptoprosopia predominated with 82%, with negligible differences according to sex, followed by mesoprosopia (14%) and euriprosopia (4%). Mean values of this variable were significantly higher than for subjects from the central Croatian region, where euriprosopia was predominant (73.5%). Gaži-Čoklica and Muretić (16) showed a secular trend of transformation of face form from euriprosopia to hypereuriprosopia in subjects from central Croatia.

According to the mean value (52.23) of the variable IF, index of the forehead also differed significantly from the same in subjects from central Croatia (70.0) which is a consequence of the significantly wider and lower forehead in south Dalmation subjects, as found in this investigation.

In the present investigation analysis of gnathometric variables (Table 5) was only performed for the sample from south Dalmatia. The anterior width was 35.3 with insignificant differences according to sex, which is a higher value than that recorded by Trkovnik (25), and slightly lower than the value

recorded by Hautz (26) and Cipruš (23) in the population from central Croatia. This variable was significantly correlated with the posterior width of the dental arch, which is logical. Negative correlation was found with variable IL (Index of the face), indicating that a narrower jaw in the anterior parts is also accompanied by narrower and higher facial dimensions which is significant in view of orthodontic treatment.

Variable Sgš - posterior upper width showed a mean value in total 45.8, which is a slightly lower value than that recorded by Cipruš (23) and Trkovnik (25). This variable, apart from the anterior upper width, is also to a certain extent correlated with the width of the mandibula, face and head. Gaži-Čoklica (19) found significant correlation of the posterior width of the dental arch with the width of the face in small girls and the width of the head in boys.

Variable Pgd (anterior upper length of the dental arch) showed a mean value of 17.9, which is less than the value found by Cipruš (23) in subjects from the Istrian-Goransko-coastal region. The length of the dental arch showed a poor correlation with the width of the forehead and upper facial height, which probably has no biological significance.

The mean value of palate height (VN) amounted to 18.9. Lower values were recorded by Heutz (26) in subjects with normal and disturbed respiration. The findings of other authors are difficult to be compare because of the different methodological approaches used to measure this variable.

Index of palate height (X = 41.7) showed predominance of a high palate in subjects from the south Dalmation region.

Conclusion

Based on an analysis of the results and discussion the following conclusions can be made:

- The mean values found in the examined cephalometric and gnathometric variables in subjects from the south Dalmation region can be used as standards for application in diagnostic orthodontic procedures for patients from that region.
- By testing the differences between arithmetic means according to sex significantly higher values were found for all variables in male subjects, which was particularly marked for the variables for index of forehead, palate height and index of palate height.
- According to the height of the head index, mesocephalia predominated in subjects of both sexes in the south Dalmatian region.
- According to the height of the face index leptoprosopia predominated in subjects from the south Dalmatian region.
- The height of the mean value for the palate index indicates a higher palate in subjects from the south Dalmatian region.
- Subjects from the south Dalmatian region differed from subjects from the north Croatian region with regard to the narrower dimensions of the head and face, increased facial height, wider, lower forehead and form of the head, where mesocephalia predominated, and according to the face, where leptoprosopia was most frequent. With regard to gnathometric variables a slightly narrower dental arch and higher palate were prominent.