The Changes of Vertical Visceral Dimensions during Growth

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Summary

The purpose of this study is to determine the changes in the posterior and anterior facial heights as well as in their proportions that occur between the age of 10 years and adulthood in subjects with normal occlusion in Croatian population.

The investigation was carried out on 199 lateral cephalometric radiographs of patients divided into five age groups. The radiographs were traced and the following measurements have been derived : s-go = posterior face height; n-m = anterior face height and s-go/n-m % = face height ratio.

Posterior face height dimensions (s-go) in total sample showed an increase of 10,72 mm between 10 years of age to adulthood (12.9%). The mean anterior face height (n-m) value in whole sample increases from 112,99 to 123,49 mm which is 10,5 mm or 8,5 %. Anterior-posterior face heights ratio showed slight increase from 63,97 to 67,14 % from the youngest to the oldest age group. All measured face dimensions are higher in males than in females in all groups.

Key words: *visceral dimensions, growth.*

Introduction

Orthodontists are interested in understanding how the face changes from childhood through adolescence and adulthood. Of particular interest is how, when and where facial growth will occur, and what happens during the various growth periods.

It is an accepted fact that the growth of the various parts of the head do not proceed at the same rate (1), and there is also a concensus that, within the dentofacial complex, the changes in the various parts of the face do not follow a constant rate with time (2-4).

According to Scammon et al the cranium follows the neural growth curve while the middle and lower anterior parts of the face follow the bodily or general growth curve (5).

Differential growth of the anterior and posterior components of the face seems to be important in the development of different facial patterns.

Lavergne and Gasson et al suggest that mandibular rotation is a mechanism to harmonize the growth rate of the component parts of the face (6). Mandibular rotation occurs when the incremental rate of growth of either the mandible or the maxilla exceeds the other (7).

Björk examined craniofacial growth in children by means of metallic implants, and described two different types of mandibular growth pattern, caused

by condylar growth direction: forward and backward rotation. His findings showed that there is a forward rotation of the mandible in the majority of cases (1). He stated that open bite subjects have an increased posterior face height, which is in contrast to the findings of Sassouni and Nanda, who claimed that it is decreased (8).

Spatial relationships among various dento-facial structures and the dimensional proportions of the facial parts during the various growth periods are important parameters that should be understood by the clinician who is planning the appropriate therapy.

The purpose of this study is to determine the changes in the posterior and anterior facial heights as well as in their proportions that occur between the age of 10 years and adulthood in subjects with normal occlusion in the Croatian population.

Subjects and methods

The investigation was carried out on 199 lateral cephalometric radiographs of patients with nearly normal occlusion (Class I molar relationship, physiologic overjet and overbite, good facial profile). The radiographs were obtained from the X-ray collection of the Department of Orthodontics, School of Dental Medicine, University of Zagreb,

The subjects were divided into five age groups (10-11, 12-13, 14-15, 16-17 and 18 years and above) (Table 1).

The radiographs were traced on acetate paper using a 0.3 mm technical pen by the conventional roentgencephalometric procedure. All cephalograms were traced by two investigators and mean values were calculated.

The following landmarks were identified on each X-ray film: sella (s), nasion (n), menton (m) and gonion (go). From these landmarks the following linear measurements were derived (Figure1)

- Variable 1 -   s-go = posterior face height;
- Variable 2 -   n-m = anterior face height;
- Variable 3 -   s-go/n-m % = face height ratio.

Statistical analysis comprised basic statistics: means, minimum and maximum values and standard deviation. Paired t-tests were conducted to determine the statistical significance of the mean changes between the youngest and the oldest age group, as well as for the significant differences between sexes.

Results

Mean values (MEAN) and standard deviations (SD) for the investigated variables according to age groups are shown in Table 2. The incremental changes of the mean values of variables according to age groups are shown graphically in Figures 2--4. By analyzing the means of the anterior and posterior facial heights we registered an increase the during growth period from childhood to adulthood. Table 3 shows the significance of differences between the means from the youngest to the oldest age group.

Discussion

The data from this investigation provide basic information on the changes in size and relationship of anterior and posterior facial heights between the ages of 10 and adulthood in the Croatian population.

Posterior face height dimensions (S-Go) in the total sample showed an increase of 10.72 mm between 10 years of age to adulthood, i.e. 12.9%. The increase was statistically significant and higher in the male population. The course of increment between marginal groups, in the total sample as well as in both sexes, was rather equalized except for the difference between the two first groups. This can be explained by a pubertal growth spurt. In their investigation of the facial growth in females, 14 to 20 years of age, Foley and Mamandras (7) found an increase of 2.97 mm which is nearly the same as in our investigation between the same groups. In the 14 year-old subjects and the oldest group they found posterior face height dimension which supports our findings. The posterior face height value at the age of 10-11 years was greater than the value reported by Bishara and Peterson (9) and Bishara (10) for subjects of 10 years of age, while anterior face height also showed smaller values. They reported mean anterior face height of 102.4 mm at 10 years and 116.8 mm at 25.5 years. Their overall values were less than the values determined in the present

study, probably because of the small sample size. Droschl registered a significant increase in this parameter in boys between the ages of 10 and 15 (13%) in comparison to girls (11).

The dynamics of posterior face height is homogenous with regard to the age groups, except lower values of growth found in the 14 and 15 year old group. Both genders exhibited the same amount of growth (Figure 2).

The variation in face height noted when various cephalometric studies were compared may be the result of population differences, different methods, or radiographic enlargement factors (7). Any of these factors creates a problem in accurate comparison of data.

The mean anterior face height (n-m) value in the whole sample increases from 112.99 to 123.49 mm, from 10 years of age to adulthood which is 10.5 mm or 8.5% (Figure 3). This finding is similar to Droschl's findings (11). The anterior face dimension reflects the intensity of the vertical growth of the viscerocranium. The anterior facial height in males was higher than in females. The average 10--11 year male anterior facial height was 114.42 mm; in the female it was 111.53 mm. At age 11-12 Chang found the average male anterior face height was 118.36; in the female it was 115.02. In adults he also found higher values than in our study (12). Rakosi registered a value of 112.8 mm in 10 year old and 126.8 in16 year old subjects (13).

Foley and Mamandras reported a mean anterior face height of 118.93 mm at 14 years and 121.7 mm at 20 years. Their overall anterior face height values were similar to values determined in the present study (7).

The higher increment in posterior vertical height over the increase in anterior vertical height is consistent with other samples which is probably one of the reasons for a decrease in the mandibular angle during the period of growth and development (14).

Anterior-posterior face heights ratio in our sample showed a slight increase from 63.97 to 67.14% from the youngest to the oldest age group. The average value for all groups was 65.3%. According to Jarabak and Fizzel a normal value of face heights ratio is between 62 and 65%(15). Higher values determine counter-clockwise and lower values clock-

wise rotations of the mandible. Bishara reported higher values (67 and 71.1 respectively) (10). The total increment of the ratio was 4.72 per cent. Consequently, this change in the ratio of the posterior to anterior total facial heights was mainly due to the greater growth potential of the posterior face. The ratio of posterior to anterior facial heights in both sexes was also increased. The changes in the ration were 5.92 and 3.73 per cent in the males and females, which is slightly different from the findings of Chang who found 7.13 and 1.53 per cent in the males and females, which displays an ethnical difference (12).

This suggested that the vertical growth in the area of the posterior face was generally greater than in the area of the anterior face, which was confirmed in studies by Chang (12).

The results confirmed the general conclusion that the ratio remained relatively stable at 63.97 to 67.14 per cent regardless of age, sex, or ethnic groups. (16, 17). All mean values in males were significantly higher than those in females which is a well known fact (18, 19). Enlow stated that the entire vertical facial height increased as maturation was reached and reflected a composite of the growth of the mandibular body and mandibular ramus, and the marked downward and forward displacement relative to the cranium (20). In other words, the consistency of the craniofacial pattern is fairly well maintained throughout the postnatal life of man.

Conclusions

As a result of the investigation we can conclude the following:

- The increment of anterior and posterior face height between the age of 10 and adulthood is significant in both sexes but more expressive in males.
- The posterior face height increment is higher (12.9%) than the anterior (8.5%) which results in a slight increase of the ratio between them.
- The course of the face height changes during the investigated period shows a marked jump between the groups of 10-11 and 12-13 years.
- Measured face dimensions are higher in males than in females in all groups.