Variations of Mandibular Variables in Skeletal Orthodontic Anomalies

Draženka Kostelac[1]
Senka Meštrović[2]
Dubravka Knezović Zlatarić[3]
Martina Mikšić[2]
Irina Filipović Zore[4]

[1]Health Clinic, Otočac
[2]Department of Orthodontics
School of Dental Medicine
University of Zagreb
[3]Department of Prosthetics
School of Dental Medicine
University of Zagreb
[4]Department of Oral Surgery
School of Dental Medicine
University of Zagreb

Summary

The object of the study was to determine the size of the mandibular angle, height of the ramus and length of the mandibular corpus, and to compare the obtained results, depending on the type of skeletal orthodontic anomaly, age and gender of the subject. Seventy-seven subjects participated in the study (30 male and 47 female) with diagnosed anomalies of open bite, mandibular prognathism and Class II/2 malocclusion, classified into three age groups. The following variables were measured on a laterolateral cephalometric radiograph: mandibular angle, height of the ramus and length of the mandibular corpus. The mandibular angle was smallest in the subjects with over bite (average 123°), largest in patients with open bite (average 135°) and in subjects with progeny it amounted to an average 130°. Statistically significant difference was found between the size of the mandibular angle and the type of anomaly ($p<0.05$). Statistically significant difference was determined between linear skeletal variables and age groups ($p<0.05$). With regard to the values of the height of the ramus and length of the mandibular corpus statistically significant difference was found between the first age group (6-12 years) and the third age group (16-18 years) ($p<0.05$). In the male subjects values for linear skeletal variables were higher than the same variables measured in female subjects, although the difference was not statistically significant.

Key words: *mandibular angle, skeletal anomaly.*

Acta Stomat Croat
2004; 127-130

ORIGINAL SCIENTIFIC PAPER
Received: December 29, 2003

Address for correspondence:

Senka Meštrović
Department of Orthodontics
School of Dental Medicine
Gundulićeva 5
10000 Zagreb
Croatia

Introduction

Knowledge of anatomy, growth and development of the craniofacial system, and recognition of deviations from normal, is important in orthodontic diagnostics and therapy. Growth is an anatomical moment, accompanied by physiological quantitative component, i.e. development, interwoven in the time component.

Skeletal anomalies are most frequently the result of asymmetrical shape and position of the upper and lower jaws, temporomandibular joint and associated structures of the head and face. The mandible is one of the causes of numerous severe forms of malocclusion. The mandible grows in processes of remodelling: apposition and resorption. Apposition is the addition of bony tissue onto the surface of the already formed bone, and resorption is the disintegration of the bony mass. In this way the basic form of the bone is preserved as a whole, including relevant relations with surrounding bones and soft tissues (1). Apart from remodelling another important process in growth and development is translation, in which repositioning of the bone occurs in the opposite direction from the direction of ossification in the area of the suture, synchondrosis or temporomandibular joint. In this way translation occurs of the nasomaxillary complex and the mandible in the anterior direction and downward (2). Translation is not the result of the pressure of forces which occur due to the formation of new bone in the area of the suture or joint, pushing the bone in the opposite direction, but is the result of the effect of surrounding bony structures and soft tissues. The condyle and ramus of the mandible grow posteriorly and upwards, thereby compensating translation which occurs because of the growth of the maxilla and adhering muscles (1,2). During growth of the mandible three types of rotation are possible: anterior rotation with the centre on incisal ridges, anterior rotation with the centre on premolars, and posterior rotation with the centre on occlusal molars. Rotation represents a series of complex changes and remodelling forms which are difficult to show and measure by conventional cephalometric techniques. The mandibular angle is one of the angles used in cephalometric diagnostics and is an important indicator of the basic trend of growth of the mandible and also of the whole of the viscerocranium. The mandibular angle changes, depending on anomaly (3) and age, i.e. the degree of growth and development (4,5). Pronounced mandibular angle indicates post-rotational growth of the mandible with posteriorly directed vector of condylar growth. While a smaller angle indicates a tendency towards anterior rotation of the mandible and vertical growth of the condyle (6-8).

The study was carried out on subjects with the following skeletal orthodontic anomalies: progeny, open and over bite. The aim of the study was to determine the extent of the mandibular angle, height of the ramus and length of the mandibular corpus and to compare the obtained results with regard to the type of skeletal orthodontic anomaly, age and gender of the subjects.

Subjects and methods

The sample was chosen from a group of patients with orthodontic anomalies (over bite, open bite and progeny) in the Department of Orthodontics, Dental Clinic, Clinical Hospital Centre, Zagreb. The study included 77 subjects; 30 male (42.8%) and 47 female (57.2%). Subjects were classified into three age groups as follows: 26 subjects (33.8%) in Group 1 (6-12 years, mixed dentition), 33 subjects (42.9%) Group 2 (13-15 years, mixed dentition), and 18 subjects (23.4%) Group 3 (16-18 years, permanent dentition). Over bite was diagnosed in 20 subjects (26%), open bite in 30 (39%) and progeny in 27 (35%). Measurements of angular and linear skeletal variables were performed immediately before orthodontic procedure. All cephalograms were recorded by conventional technique and relevant structures copied on tracing paper onto a negatoscope and the following variables measured (Figure 1).

m-go-ar (degree) mandibular angle

ar-go (mm) height of the mandibular ramus

pg-go (mm) length of the mandibular corpus

Data were analysed by using SPSS 10.0 statistical package (descriptive statistics, test of

distribution normality, parametric statistics). Test of distribution normality was performed by means of the (one way/unidirectional) Kolmogorov-smirnov test. The results showed that the tested variables were normally distributed ($p>0.01$) and consequently parametric tests were used.

Results and discussion

The mandibular angle (m-go-ar) is considered an important indicator of mandibular growth trend (9). Its size depends on age, gender and type of orthodontic anomaly. Higher values of the mandibular angle were measured in the female subjects compared to the male subjects in all age groups, although the difference was not statistically significant ($p>0.05$). With regard to the age of subjects, the measured variable of the mandibular angle decreased with the age of the subjects, regardless of gender (Figure 2). Muretic & Rak (10) found reduced value of the mandibular angle from age 10 years to adulthood, amounting to 7.6° and 5.82°, with a significant decrease in its upper segment. In subjects with mandibular prognathism they also found a tendency to reduced mandibular angle with an average reduction of 3.1° from primary to permanent dentition. Broadbent et al (11) recorded a decrease in the value of the total mandibular angle from 127.2° to 124.8° from age 10 to 18 years. Droshl (12) found a drop in the total angle from 10 to 15 years of 128.7° to 123.6°.

The mandibular angle was smallest in subjects with overbite (average 123°), and largest in subjects with open bite (average 135°), and in subjects with mandibular prognathism average 130° (Figure 3). Statistically significant difference was found between the size of the mandibular angle and the type of anomaly ($p<0.05$) for all types of anomalies ($p<0.05$). Štambuk Cosic (13) obtained similar results. In subjects with mandibular prognathism they found average mandibular angle of 131.55°, and for open bite enlarged angle average of 134°, and they considered that specific growth of the mandible was the reason for such enlargement. For the same age Guyer (14) found average value of 126.1° in subjects with mandibular prognathism. Meštrović et al (15) found average value of 125.36° for the mandibular angle in eugnathic subjects, and in subjects with open bite 135.74°. Cangialosi (16) found average size of the mandibular angle in a group with open bite of 132.5°, and in eugnathic subjects 123.9° with the level of statistical significance $p<0.01$. Rak (17) found average value of the mandibular angle of 129.8° in subjects with class II/1. By comparing the changes in the mandibular angle of subjects with open and deep bite aged 6 to 12 years and 12 to 15 years Karlsen (18) found decreased size of the angle with growth in both examined groups. De considers that the decrease in the mandibular angle correlates with rotation matrix and not with intramatrix rotation of the mandibular corpus. The mandibular angle decreases with anterior rotation of the matrix. During the period from 6 to 12 years decrease of the angle is greater in the group with anterior rotation of the matrix, while in the period from 12 to 15 years the rotation of the matrix has no effect on the reduction of the angle. Maj & Lucchese (19) found lower values of the mandibular angle in a sample of 60 subjects with class II/2, aged 9 to 12 years, compared with eugnathic subjects, and also decrease in values with increasing age. For each age values of the angle were higher in female subjects than male.

The height of the mandibular ramus (ar-go) is a clinically significant parameter because the definitive shape of the lower facial third and rotational growth of the mandible depend on its intensity and direction of growth.

In this study the values of the height of the mandibular ramus were higher in the male group, in which the average value was 47.73 mm, while in the female group the average value was 45.41 mm, which gradually increased with the age of the subjects (Figure 4). In the age group from 6 to 12 years the value measured was 43.38 mm, in the age group from 13 to 15 years 46.81 mm and in the oldest age group, from 16 to 18 years, 49.66 mm (Figure 5). The height of the mandibular ramus was almost equal in subjects with over bite (average value 45.45 mm) and open bite (average value 45.66 mm). While in subjects with progeny it was higher (average value 47.7 mm) (Figure 6). Karlsen (18) compared subjects with open bite and deep bite and found greater increase in the

height of the mandibular ramus in the group with deep bite than open bite, amounting to 8.3 mm for age 6 to 12 years and 5.3 mm for age 12 to 15 years in the group with deep bite, and 6.9 mm and 5.5 mm for the group with open bite. Snodell (20) monitored longitudinally a group of eugnathic subjects aged 6 to 18 years. The left and right height of the ramus significantly correlated as an example of bilateral symmetry. The height of the ramus showed great growth which significantly influenced the facial structure. This was particularly the case for male subjects who at the age of 12 years only had 85% of the total height which was attained at 18 years. Furthermore, growth had not been entirely completed by the age of 20 years for the majority of the males. Greatest growth was attained from 13 to 14 years for girls and 15 and 17 years for boys. Baughan et al. (21) consider that increased height of the mandibular ramus during puberty corresponds to the curve of general skeletal growth. With continued growth of the ramus the mandibular plane becomes more horizontal and the angle between the mandibular plane and Frankfurt horizontal reduces, which agrees with the findings of Nanda (22). On the basis of measurements of the distance between sela - gonion, which corresponds to the height of the mandibular ramus, he concludes that this growth is more proportional than in any other facial structure. Pavlec Weber (23) found total growth between marginal groups of 9.7 mm or 19% in a sample of groups aged from 10 to 18 years. Broadbent et al. (11) also registered an increase in this variable in the same period for boys, amounting to 23.8%, and 16.4% in girls.

The values of the length of the mandibular corpus (pg-go) were also higher in male subjects and amounted on average to 78.66 mm, while in female subjects they were on average 76.93 mm. A gradual increase was noticed with age for both male and female subjects (Figure 4). In the age group from 6 to 12 years length amounted to 74.73 mm, in the age group from 13 to 15 years it was 77.95 mm and in the oldest age group, from 16 to 18 years, 81.12 mm (Figure 5). The length of the mandibular corpus in subjects with over bite (76.76 mm) was slightly greater than the length of the mandibular corpus in subjects with open bite (76.27 mm). while in subjects with progeny it was highest (79.71 mm) (Figure 6). Karlsen (18) compared subjects with open and deep bite and found equal growth in the length of the mandibular corpus in both examined groups, amounting to 10.5 mm for age 6 to 12 years and 4.7 mm for age 12 to 15 years for the group with deep bite and 9.6 mm and 4.4 mm for the group with open bite. Pavlec Weber (24) found an increase in the length of the mandibular corpus in the period from 10 to 18 years of 11.5%, and all values were statistically significantly greater in male subjects in all age groups. For the same period Broadbent et al. (11) arrived at almost identical results. Rakosi (8) reports a value of mandibular corpus length of 68 mm at age 8 years, with yearly growth of 2 mm for boys and 1.4 mm for girls. In this study One way ANOVA test showed statistically significant difference between skeletal variables and age groups ($p<0.05$). By additional testing with Post hoc Scheffeov's test statistically significant difference was determined for the values of the height of the ramus and length of the mandibular corpus between the first group (6-12 years) and the third group (16-18 years) ($p<0.05$). In the male subjects values of the linear skeletal variables were higher than the same variables measured in the female subjects. Although difference was found between the measured values in the male and the female group it did not reach the level of significance ($p<0.05$).

Conclusions

1. Average values for the mandibular angle and linear skeletal variables were not significantly different depending on the gender of the subject ($p<0.05$).
2. The mandibular angle differed significantly for all three examined anomalies: normal bite, open bite, and mandibular prognathism ($p<0.05$), and decreased with increasing age.
3. Values of the height of the ramus and length of the mandibular corpus increased with increasing age ($p<0.05$).
4. In male subjects values of the linear skeletal variables were higher than the same variables measured in female subjects, although the difference was not statistically significant.