Dentoalveolar Characteristics in Subjects with Anterior Open Bite

Senka Rajić-Meštrović[1]
Marina Lapter[1]
Želimir Muretić[1]
Josipa Kern[2]

[1]Department of Orthodontics
School of Dental Medicine
University of Zagreb
[2]School of Public Health
"Andrija Štampar", Zagreb

Acta Stomatol Croat
2000; 169-172

Summary

The purpose of this study was to determine the frequency and extent of dentoalveolar compensation in subjects with disharmonious vertical jaw base relationships, in relation to subjects with normal occlusion. The study was performed on 37 lateral cephalograms of patients with open bite and 35 of patients with normal occlusion, aged 15 to 18 years. Each cephalogram was traced twice by two authors. The cephalometric analyses were performed by linear and angular measurements. The angular cephalometric variables were: n-s-gn, sp-pm:m-go, m-go-ar, the sum of the posterior angles according to Björk (1947, 1954,1966,1972),1:sp-pm and 1:m-go. Linear cephalometric variables: oi, om oi/om, ui, um and ui/um were analysed using the methods of Korkhaus (1959). Statistical data analysis included descriptive statistics, method error, t-test and Pearson(s correlation coefficient for association between variables. Significant differences ($p < 0.001$) between the samples were found in all investigated variables except 1:sp-pm, oi/om and um. Retrusion of the lower incisors was found, indicating dentoalveolar adaptation to the present posterior rotation of the mandible. Inclination of the upper incisors in relation to the base of the maxilla was significantly negative correlated with the variable n-s-gn, and slightly negatively by correlated with the variable sp:pm-m-go. The variables of the height of the upper and lower jaws (oi, om, ui, um) were significantly correlated. A significiant negative correlation was found between variables um and m-go-ar. The correlation between variable um and Bjork's polygon was slightly negative. The variable ui showed slight negative correlation with the variable m-go-ar. Such a relationship is the result of compensatory retrusion of the lower incisors and a steep mandibular plane.

Key words: *anterior open bite, dentoalveolar characteristics*

ORIGINAL SCIENTIFIC PAPERS
Received: January 5, 2000

Address for correspondence:

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

Introduction

Anterior open bite is one of the most difficult orthodontic problems because it is commonly associated with skeletal jaw discrepancies (1). Many aetiological aspects of anterior open bite are presented in the literature, however generally three aetiologic factors are considered to be associated with open bite (1-6):

1. Vertical growth deficiencies
2. Disproportionate muscle growth or aberrant muscle function
3. Thumb - and finger - sucking habits.

Skeletal open bite mostly involves an increased anterior facial height, increased mandibular angle and excessive eruption of the posterior teeth (7).

Open bite is usually considered as a deviation in the vertical relationship of the maxillary and mandibular dental arches with a lack of contact between opposing segments of teeth. If however, a dentoalveolar compensatory mechanism is involved, functional occlusion can be reached .

Few researchers have used individualized analyses to discuss the frequency and amount of dentoalveolar compensation in vertical jaw discrepancy cases (8-13).

The coordination of the development of upper and lower jaws is not always perfect. Some mechanism is therefore needed to co-ordinate the eruption and position of the teeth relative to their jaw base in order for a normal relationship between upper and lower dental arches to be achieved and maintained (12). The existence of such dento-basal adaptations has been demonstrated in individual case analyses and by statistical methods (14-18). The inclinations of the incisal and lateral segments of the dental arch, the dental arch width and the alveolar process height in each jaw are associated with the length, width and prognathism of the opposite jaw, and also with the sagittal, vertical and transverse intermaxillary relations. These associations all reflect a tendency to maintain normal occlusal relationship between the dental arches, despite the variation in the intermaxillary relations (17).

The aim of this study was to identify the skeletal and dentoalveolar parameters, which differ most in subjects with anterior open bite in relation to with subjects with normal occlusion, and to describe those of them which influence dentoalveolar compensation.

Subjects and method

The subjects in this study were selected from the Department of Orthodontics, School of Dental Medicine University of Zagreb. The sample consisted of 37 lateral cephalometric radiographs of anterior open bite patients and 35 subjects with ideal occlusion (Björk = 390,0° ± 5,5°; sp-pm:m-go = 25° ± 5,0°; m-go-ar = 127,5° ± 5,0°) of both sexes. All subjects were aged between 13 and 15 years. The following criteria were considered in the selection of open bite patients: Björk > 390.0° ± 5.5°; sp-pm:m-go > 25° ± 5.0°; m-go-ar > 127.5° ± 5.0° according to the findings of roentgencephalometric method "Zagreb 82" (19).

In total, 12 skeletal and dentoalveolar parameters were measured (19,20). These are illustrated in Figure 1 and defined in Table 1. Two authors traced and measured all cephalograms once. The inter observer method error was assessed for both groups and results indicated that the error was not statistically significant. Data were analysed by means of the (SPSS-PC). Student's t-test was used to estimate the level of significance of the differences between the means of the investigated groups. Pearson's and Spearman correlation coefficients were used for both groups of patients to identify the variables which best correlated with the severity of open bite.

Results

Table 2 shows mean values, standard deviations and standard errors for both investigated groups, and the significance of the difference between arithmetic means. The mean values of all skeletal variables showed statistically significant differences between the investigated groups ($p < 0.05$). Apart from the values for inclination of the upper incisors in relation to the base of the maxilla, no differences in dentoalveolar variables were found between the

subjects with open bite and the control group, while the values of the inclination of the lower incisors in relation to the base of the mandible were lower in subjects with open bite, at the level of significance $p < 0.05$. The values of the height of the upper jaws, measured in the region of the incisors and molars, were statistically significantly ($p < 0.05$) higher in subjects with open bite. The value of the ratio of these two variables was slightly lower in subjects with open bite, although the difference was not statistically significant. The values of the height of the jaws, measured in the incisor region, were statistically significantly ($p < 0.05$) higher in the group with open bite, while this height, measured in the molar region, was higher in the group of subjects with open bite, although the difference was not statistically significant.

The inclination of the lower incisors in relation to the base of the mandible was significantly negatively correlated with the variables sp:pm-go,m-go-ar and Bjork's polygon, and the correlation with y-axis was slightly negative, resulting in retrusion of the lower incisors, indicating dentoalveolar adaptation to the present posterior rotation of the mandible (Table 3). Inclination of the upper incisors in relation to the base of the maxilla was in negative correlation with the variable n-s-gn, and in slight negative correlation with the variable sp:pm-m-go. The variables for height of the upper and lower jaws (oi, om, ui, um) were in mutual significant correlation, and correlation between the variables ui and um was very high. A significiant negative correlation was found between the variables um and m-go-ar. The correlation between the variable um and Bjork's polygon was slightly negative. The variable ui showed slight negative correlation with the variable m-go-ar. Such a relationship is the result of compensatory retrusion of the lower incisors and a steep mandibular plane.

Discussion

Solow (17) found a slight negative correlation between the inclination of upper incisors and the facial height , while the correlation was significant and negative with the interincisal angle. Inclination of the lower incisors was in significant negative correlation with the mandibular angle and with the interincisal angle, and slightly negative with facial height, which agrees with the results of this study. The upper alveolar height was in significant correlation with the lower alveolar height, and also in relation to facial height, and slightly with the mandibular angle. It was also in slight negative correlation with the inclination of the upper incisors. The lower alveolar height was in significant correlation with the upper alveolar height and with facial height, while correlation with the mandibular angle was insignificant. Subtenly and Sakuda (6) compared the skeletal and dental relationship of 25 subjects with persistent open bite with a group of 30 subjects with normal occlusion. All subjects were aged over 12 years. They found significantly greater eruption of the maxillary molars and incisors, which was confirmed in the present investigation. They also found excessively steep mandibular plane angles and significantly greater gonial angle in open bite subjects. In the mandibles of the open bite subjects excessive height of the dental alveolar segments, such as that seen in the maxilla was not found in either the molar or the incisor region. In this study only excessive eruption of mandibular incisors in open bite subjects was found. Tsang et al. (21) reported that with increasing severity of anterior open bite, the maxillary dentoalveolar vertical heights were the significant factors. Severity of anterior open bite correlated with a direct proportional increase in the posterior dentoalveolar height, and was inversely proportional to the anterior dentoalveolar height. Schudy (22), Isaacson et al. (23) and Pancherz and Groten (8) found that posterior maxillary alveolar height has more influence on vertical jaw dimension than mandibular. Creekmore (9) in 7-14 year old subjects with a high interbasal angle, found that the increase of dentoalveolar vertical height in the maxilla is greater in the molar than in the anterior region, while in the mandible it is vice versa. Pancherz and Groten (8) found in adult patients (18-36 years) that the dentoalveolar vertical height is greater in the maxilla than in the mandible, and is located more in the anterior than in the posterior region. In this investigation only correlation between the interbasal angle and maxillary anterior dentoalveolar height was found which supports these studies. Richardson (24) noted that both dental and skeletal factors may play a role in determining the degree of incisal

overbite. In his study of 110 lateral radiographs of open bite patients aged from 7 to 27 years, he found that the mean for the angle m-go-ar was 134.92 degrees while in this sample it was 135.74 degrees. He regarded, m-go-ar as the key angle, and an increase in this angle as well as in angle s-ar-go would have the effect of "opening up" the anterior part of the face. In the present investigation it was found that an increase in angle m-go-ar in open bite subjects correlated with a decrease in lower anterior and posterior dentoalveolar height which is a result of a decrease in inclination of the lower incisors. Sassouni and Nanda (13) found that the anterior and posterior dentoalveolar vertical heights in the maxilla are greater in open bite patients than in normal subjects. A similar pattern of dentoalveolar compensatory mechanism was found in this study.