Cephalometric Evaluation of the Incisor Position in Subjects with Angle Class II/1 and II/2

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Summary

The aim of this study was to determine the mean values and standard deviations of variables that evaluate the inclination and position of incisors in patients with Angle Class II/1 and Class II/2; to determine the statistical significance between investigated variables among groups; and to point out the most significant variable for evaluating the difference between these Angle Classes.

The sample consisted of 38 radiographs of patients with Angle Class II/1, and 35 radiographs of patients with Class II/2.

The analysis comprised 10 variables: 1 : sp-pm, 1 : m-go, 1 : 1, Is : n-ss, Ii : n-sm, 1 : n-s, Is : A-Pog, Ii : A-Pog , 1 : n-A (°), 1: n-B (°). Means and standard deviations were determined for all variables, and Student t-test were performed to test the differences between investigated groups.

It could be concluded that there is significant difference between all investigated variables between subjects with Angle Class II/1 and Class II/2 except for the variable Ii:n-sm.

The main dentoalveolar characteristics of subjects with Angle Class II/1 are protrusion of upper and lower incisors in relation to their skeletal base, and protrusion of upper incisors in relation to the anterior cranial base, while Class II/2 patients exhibited retrusion of upper incisors in relation to the basal bone and to the anterior cranial base.

Key words: *incisor position, Class II/1 and II/2.*

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Introduction

Orthodontic anomalies can be diagnosed by standard gnathometric diagnostic methods, or by additional diagnostic procedures such as the analysis of orthodontic photography or roentgencephalometrics (1).

Roentgencephalometric analysis in diagnostics or differential diagnostics of Class II/1 and Class II/2 anomalies is very important because it is very hard to determine skeletal components of Class II anomalies clinically (2, 3).

Because of the high frequency of this orthodontic anomaly it is important to apply relevant diagnostic methods. The occlusal relationship can be easily recognized according to Angle's classification, based on the first molar relationship, but skeletal components can only be identified by roentgencephalometric analysis (4).

Schmuth and Kreisel stated in their studies that in most cases the gnathometric and roentgencephalometric findings did not correspond. Similar results, emphasizing the rare finding of identical occlusal and skeletal relationships were confirmed by other authors (5-9).

Pancherz et al. (10) concluded that apart from the position of the incisors there is no significant difference between the dentoskeletal morphology of Angle Class II/1 and II/2 malocclusion.

The orientation of the incisor position in relation to the skeletal cranial structures can be evaluated by their position, using linear parameters and angular relationship to determine their inclination.

The majority of the roentgencephalometric parameters, evaluating the position of the upper and lower incisors, can only be used when the individual morphological characteristics of other angular or linear values are completely understood. Reference lines, based on points distant from the incisors, can be influenced by the local craniofacial morphology, which can lead to false interpretation of parameters used for evaluation of the incisor position (11).

Aims

The aims of this study wereas follows:

- To determine the mean values (x) and standard deviation (sd) of variables that evaluate the inclination and position of incisors in patients with Angle Class II/1 and Class II/2.
- To determine the statistical significance between the investigated variables among the groups.
- To point out the most significant variables for evaluating the difference between Angle Classes II/1 and II/2.

Material and methods

The sample consisted of 38 radiographs of patients with Angle Class II/1 and 35 radiographs of patients with Class II/2. The radiographs were selected from the records of the Department of Orthodontics, School of Dental Medicine, University of Zagreb. The control sample consisted of eugnathic patents with Angle Class I sagittal maxillomandibular relationship from Zagreb, 82-MOD analysis. (V1-V5) (12). The mean values for variables from other roentgencephalometric analyses (V6-V10), were based on "normal" values stated by the authors of those analyses (13).

All radiographs were taken by conventional cephalometric technique, and points and lines were traced on acetate paper. All measurements were made with accuracy (precision) of ± 0.5 mm and 0.5 degrees.

The analysis comprised 10 variables (Pictures 1 and 2)

V1 = $\underline{1}$: sp-pm	- Inclination of upper incisors
V2 = 1 : m-go	- Inclination of lower incisors
V3 = $\underline{1}$: 1	- interincisal angle
V4 = Is : n-ss(A)	- The distance between the upper incisor and the line defining maxillary prognathism
V5 = Ii : n-sm(B)	- The distance between the lower incisor and the line defining mandibular prognathism
V6 = $\underline{1}$: n-s	- Inclination of the upper incisors to the anterior cranial base
V7 = Is : A-Pog	- The distance between the incisal edge of the upper incisor to the line connecting points A and Pog
V8 = Ii : A-Pog	- The distance between the incisal edge of the lower incisor to the line connecting points A and Pog
V9 = $\underline{1}$: n-A	- Axial inclination of the upper incisors
V10 = 1 : n-B	- Axial inclination of the lower incisors.

Statistical analysis comprised basic statistical data: means, standard deviations, maximal and minimal values. Student t-test was performed to test the differences between investigated groups.

Results and discussion

Table 1 shows the values of basic statistical data: means (x), standard deviations (sd), minimum and maximum values for each variable in subjects with Class II/1, while the values for Class II/2 subjects were shown in Table 2.

Table 3 comprised the significance of the differences between means of investigated variables between two groups, achieved with Student t-test.

The value of the variable 1 : sp-pm (V1) that defines the inclination of the upper incisors to the maxillary base for eugnathic patients in our population is 111.5° (12). In patients with Class II/1 we found a higher value (120.4°), which is similar to the results of Rak and Muretić (115.4°) (14), and Pancherz (10) who reported values of 114.5° and 114.3°.

Lower values for this variable were found in patients who exhibited Class II/2 (102.4°).

Rak and Muretić report 98.1° and Pancherz 97.8° and 98.4°. Such findings were expected because the main characteristic differentiating these two anomalies is the position and inclination of the upper incisors.

The difference between the values of this as well as other variables, apart from 1 : n-sm , that defines the position of the lower incisors to the apical base of the mandible was statistically significant between the investigated groups.

The increased value of the V2; the inclination of the lower incisors to the mandibular base, found in class II/1 (96.71°) patients, and a decreased value was found in Class II/2 (90.88°) compared to eugnathic subjects 92° (12).

Pancherz et al. (10) in subjects with Class II/1 found 93.1 degrees, which is less than the values found in this investigation, and for Class II/2; he found 90.5°, which is identical to our results.

The value for the V3, the interincisal angle (1 : 1), for eugnathic patients in our population is 131.5°, while investigated Class II/1 subjects have 117.27° and Class II/2 have 144.29 degrees.

The interincisal angle is very decreased in patients with Class II/1 anomaly because of the protrusion of the upper and lower incisors. It is increased in patients with Class II/2 anomaly because the retrusion of the upper incisors.

The linear variable Is:n-ss defines the position of the upper incisors measuring the greatest distance from the maxillary prognathism line. For eugnathic subjects in the Croatian population the mean value is 4.5 mm. We found higher values in patients with Class II/1 (7.01 mm) and lower for Class II/2 patients (2.34 mm). Other authors found similar results. Blažević and Muretić (4) in Class II/1 patients found 6.04 mm, Rak and Muretić 7.1 mm and 2.6 mm in Class II/2 (14); Hitchock (15) 7.2 mm (II/1) and 3.4 mm (II/2).

The variable Ii-n-sm, defining greatest distance from the lower incisor to the mandibular prognathism line and the mean for eugnathic subjects in our population is 4.5 mm.

The investigated groups showed the following values: 5.09 mm for Class II/1 and 2.198 mm for Class II/2. Blažević and Muretić found 5.3 mm (II/1) and 3.8 mm (II/2) (4); Hitchcock found 6.7 mm (II/1) and 4.0 mm (II/2) (15).

To evaluate the position of the incisors variables Is : A-Pog (V7) and Ii : A-Pog were also measured. These variables show the distance from the incisal edge of the upper/lower incisor to the facial line, A-Pog. Ricketts considered that the A point represents the farthest point of the maxillary corpus and Pogonion the most anterior point of the mandibular corpus. He therefore stated that the incisal position is better determined with linear variable, by measuring the distance between the top of the incisal crown to the A-Pog line, which he called the "dental plane", than with angular variable, that does not explain the spatial relationship as clear by milimeters. As a reference value he reported 1 mm with clinical variations of ± 2 mm for V8 (16, 17).

Downs believes that these measurements describe the balance between the teeth and the profile, and for eugnatic patients reported values from -2 mm to +3 mm for V8 and 2.7 mm for V7 (18-20).

If the face is convex and retrognathic, the difference between the maxillary and mandibular base is more evident, while the lower incisors have an increased labial inclination. For lower incisors this investigation showed increased values in Class II/1 (0 mm) and decreased in Class II/2 (-2.29 mm) subjects. Both measures are lower than those in eugnathic subjects, which reveal retrusion of lower

incisors in both investigated groups. For upper incisors the differences are more pronounced; 9.79 mm in Class II/1, indicating strong incisal protrusion and 3.56 mm for class II/2.

Variables V6, V9 and V10 are angular. Blažević and Muretić (4) described the relationship between the upper incisor to the s-n line and found 102.1° in eugnathic subjects, and 107° in Class II/1 subjects. Hitchcock (15, 21) found 103.8° (Class I), 107.4° (II/1) and 92.2° (II/2).

In this investigation Class II/1 patients showed higher values, i.e. 111.42°, while Class II/2 patients showed lower values 90.83°. This value determines the relationship between maxillary incisors and anterior cranial base, regard less of the maxillary and mandibular position. A higher 1 : n-s angle in Class II/1 subjects reveals maxillary incisor protrusion, and a lower angle, found in Class II/2 an extremely flat incisal position.

Variables V9 and V10 are also angular, although they can be presented as linear. They were introduced by Steiner (13) who suggested 22° for eugnathic patients for the relationship between the upper incisor to n-A line (V9) and 25° for the lower incisor relationship to n-B line (V10). For V9 variable Hitchcock (15, 22) presents 23.2° for Class I, 26.5° for Class II/1 and 11.1o in II/2 subjects. Our results for the V9 were 29° for Class II/1 and 26.47° for V10; while the values for these variables in Class II/2 subjects were 11.89°; and 19.53° respectively.

Conclusions

From this study the following can be concluded:

- There was a significant difference between all investigated variables between subjects with Angle Class II/1 and Class II/2 except for the variable 1:n-sm, which determines the position of the lower incisor to the mandibular apical base.
- The main characteristic of the position of the incisors in Class II/1 subjects was their protrusion in relation to the maxillar and anterior cranial base, and other referent structures, and the protrusion of the lower incisors to the mandibular base, which leads to decreased interincisal angle and retrusion of the lower incisors to the A-Pog line.
- The main characteristic of the position of the incisors in Class II/2 subjects was their retrusion in relation to the maxillar base, with increased interincisal angle, and retrusion to the anterior cranial base and other referent structures used in this study.
- Roentgencephalometric analysis in subjects with Class II/1 and Class II/2 is essential because of the specific dentoskeletal morphology which distinguishes these two anomalies, which is very important in planning and managing anorthodontic treatment.