Cephalometric Evaluation Of The Size And Morphology Of Sella Turcica In Different Types Of Malocclusion Among Romanian Subjects

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Abstract

Introduction: The vertical and sagital position of the maxilla and mandible is influenced by the size and the angulation of the cranial base. Sellae turcica is part of the cranial base. It is located in the middle cranial fossa. Thus, the growth and the development of this bony structure are influenced by neural and general skeletal pattern as well. Cephalometric analysis is an important part of orthodontic diagnosis and treatment planning. From numerous cephalometric landmarks, the S- sellae point is commonly used to describe the cranial base. Also, it is used to evaluate other bony structures' position towards it. Objective: The purpose of this study is to evaluate the shape and the dimension of the sellae turcica in different types of malocclusions. Materials and Methods: 136 randomly selected lateral cephalometric radiographs were analyzed. Also, skeletal and facial pattern was identified and the shape and sagital dimension of the sellae was measured. Results: Statistical analysis presented no significancy regarding sellae's shape in different types of malocclusion. However, the skeletal class II cases presented the most anarchic sellae shapes. Comparing linear measurements of skeletal length and sellae diameter, we found that the smallest diameter of the sellae appears in class III malocclusions. Thus, other skeletal length presents the lowest mean values also. Statistically significant differences among maxillary, mandibular, and cranial base length and sellae diameter were found in class I malocclusion (p=0.013). Conclusions: Sella morphology appears to have certain correlation with cranial and jaw base length and jaw base relationship in skeletal Class I Romanian population

Keywords: Sella turcica, sella shape, sella diameter, lateral cephalogram, malocclusion

Introduction

The relationship between the cranial base, facial, and dentalarch morphology is mostly the concerns of an anthropologist, especially in studies of racial differences. Studies on dried skulls revealed certain modifications of the angulation of the skull base determined by racial variations (Huxley, 1867). Furthermore, a relationship was found between these variations and the different types of malocclusions (Coben, 1998). The conclusions of Björk's follow-up X-ray study on 243 Swedish individuals showed that in coordination with the rotation of the cranial base and the brain case, there is also a rotation of the facial structures. In addition, there is a correlation between the morphology of the skull base and the position of the maxilla and mandible to each other and both to the skull base (Bjork, 1969). Regarding the development and growth of the skull, it was found that individual segments of the cranial base follow either the neural or the general skeletal pattern of growth, but not an intermediate one (Moffitt, 2011).

However, one of the most important parts of the cranial base is the sella turcica. It is located in the middle cranial fossa; lies on the intercranial surface of the body of the sphenoid; consists of a central pituitary fossa; and is bounded anteriorly by the tuberculum sellae and posteriorly by the dorsum sellae. Two anterior and two posterior clinoid process project above the clinoid fossa. Thus, these can be fusion which is forming the sella turcica bridge.

The anatomy of the sellae is variable and has been classified into five types: round, oval, flat, shallow, and J-shaped. The size of the sellae is also variable; the antero-posterior diameter varies from five to 16 mm; and the vertical depth varies from four to 16 mm (Moffitt, 2011).

The relationship between malocclusions and skeletal morphology is a popular topic of maxillofacial developmental research. As one of the most common diagnostic records is the cephalogram, the relationship among cranial base, maxilla, and mandible can easily be determined. Using Steiner's cephalometric analysis, malocclusions can be easily classified by ANB angle. Consequently, facial type or vertical diagnosis can be performed by measuring the Down's MP (mandibular plane) angle (Jacobson et al., 2006).

Consequently, the sagital length of the maxilla is represented by the distance between the most anterior (SpNA) and the most posterior (SpNP) bony point of it. Mandibular basal length can be measured between two cephalometric points: gnathion (Gn) and gonion (Go). However, the distance between the middle of the sellae turcica (S) and the naso-frontal suture (N) represents the length of the anterior cranial base.

The aim of this study is to compare the cranial base length, the sellae turcica morphology and dimension, and the maxilla and mandible length which are the different types of malocclusions.

Materials and Methods

After the research protocol was established, it was approved by the Ethical Committee of Scientific Research of the University of Medicine and Pharmacy from Tirgu Mures. A written consent was obtained from each patient or their parents/legal representative in order to use patient's radiographs for this study.

Pretreatment lateral cephalometric radiographs were randomly chosen from 136 Romanian subjects. These subjects were referred for orthodontic treatment at the Orthodontic Department of the University of Medicine and Pharmacy Tirgu Mures. Subjects mean age was 12.3±3.8, 60.2% were female, and 39.8% were male subjects. Furthermore, all subjects were clinically healthy with no syndromes, clefts, or other malformations. Therefore, only good quality radiographs were used and malocclusion type was not criteria for sample selection.

All lateral cephalograms were taken with the same X-ray machine by trained radiographer. Manual interpretation of all cephalograms was performed by two orthodontists. Also, experienced clinicians who are familiar with lateral cephalometric radiographs interpretation were involved in this study. Cephalograms were numbered. Thus, at the time of the analysis, the observers could not identify the patient. Mean values of the two determinations were calculated for each measurement.

Table 1. Definition of the reference points, lines, and angles used in the analysis of the lateral cephalometric radiographs

Variable	Definition
S	midpoint of Sellae Turcica
N	anterior limit of naso-frontal suture
A	anterior limit of the apical base of the maxilla
B	anterior limit of the apical base of the mandible
Gn	most inferior point of the lower contour of the bony chin
Go	gonial tangent point
SpNa	anterior tip of the nasal spine
SpNP	the most posterior aspect of the palatine bone
N-S (mm)	anterior cranial base
Go-Gn (mm)	mandibular plane
SpNA-SpNP (mm)	palatal plane
ANB (Steiner) (°)	point A- nasion – point B
MP (Downs) (°)	mandibular plane and Frankfort horizontal

Consequently, anterior cranial length (S-N), maxillary length (SpNA-SpNP), and mandibular base length (Gn-Go) were measured in this study. Using the ANB (Steiner cephalometric analysis) and MP angles (Downs cephalometric analysis), skeletal sagital and facial type diagnosis was performed (Jacobson et al., 2006). The diameter of the sellae turcica was determined using a professional ruler. Thus, the diameter was measured as the largest antero-posterior dimension, parallel with the Frankfort horizontal. The data was stored and processed in the statistical Microsoft Excel table. Also, statistical significance was performed using GraphPad InStat program.

Results

34% of the subjects showed class I; 59% class II; and 7% shows class III skeletal malocclusion. By analyzing the skeletal disorder by subject's gender, we found the following percentages: female subjects 20.5 % (male 13.2%) class I, 33.8 % (males 25%) class II, and 5.8% (males 1.4%) class III. Thus, the statistical significancy was p=0.0690.

Subsequently, vertical skeletal diagnostics was performed by MP angle. Also, we found the following distribution: 30.8% hiperdivergent, 51.47% normodivergent, and 17.64% hipodivergent. 40 subjects were normodivergent-class II. On the other hand, 28 subjects were diagnosed as hiperdivergent –class II. From class I subjects, most were normodivergent as well. Therefore, we found no statistical significancy, as p=0.600.

Table 2. Descriptive statistics of skeletal diagnostics (*p=0.600 – no statistical significancy)

Subjects (=136)*			
	Hypodivergent MP<22º	Normodivergent MP=25±3º	Hyperdivergent MP>28º
Class I. ANB=2-4º	12	24	10
Class II. ANB>4º	12	40	28
Class III. ANB<4º	0	6	4

Consequently, statistically significant differences among linear skeletal parameters and sellae diameter were found in class I malocclusion (p=0.013). 58.87 % of the subjects presented round shaped sellae (62.5% were skeletal class II), 23.52% oval shape (40 % of them presented class I malocclusion), 16.17% presented shallow shape, and 1.44% of the cases presents a flat shape. Statistical analysis presented no significancy (p= 0.729) regarding sellae's shape in different types of malocclusion. However, skeletal class II cases presented the most anarchic sellae shapes.

Table 3. Descriptive statistics of skeletal lengths and sellae dimension in different malocclusions

	Class I.**			Class II. (p=0.215)			Class III. (p=0.1)		
	min.	Mean	max.	min.	mean	max.	min.	Mean	max.
S-N(mm)	66	71.6	87	63	69.5	76	66	70.6	74
SpNA-SpNP (mm)	45	52.3	60	45	52.8	65	41	49.2	57
Go-Gn (mm)	61	71.1	80	60	67.6	83	65	71	78
Sellae diameter (mm)	7	9.6	13	7	9.65	13	7	9	10

** significantly different values for class I. (p=0.013)

Comparing linear measurements of skeletal length and sellae diameter, we found that the smallest diameter of the sellae appears in class III malocclusions. Here, other skeletal length presents the lowest mean values also.

Discussions

The need for Orthodontic treatment is presenting an increased tendency nowadays. Population-based studies revealed that malocclusions occurred primarily in girls (Komazaki et al., 2012). Therefore, cross-sectional studies showed that the prevalence of malocclusion traits did not change with class I being more prevalent in all the age groups and gender. Thus, this is followed by class II and class III. Females were observed to have more class I than males (Kashif, 2014). Some epidemiological surveys concluded that boys present a higher number of class II and class III malocclusion (Tang et al., 1993; Koamazaki et al., 2014). Even though no statistical significancy was obtained regarding class I and class II malocclusions, our data showed a slight increase in the percentage of class II malocclusions for both genders.

Analyzing the correlation of the facial type and malocclusion, we found that the most fervent facial morphology described a normodivergent facial architecture in class I and class II malocclusions. In addition, the same results were found in several epidemiologic studies (Siriwat et al., 1985; Saltaji et al., 2012). Nevertheless, most of them revealed that vertical and sagital skeletal growth and development was strongly influenced by rase and function.

An average dimension of the sellae is difficult to predict, although significant differences were found between the older (15 years or more) and the younger (11-14 years) age groups regarding length, depth, and diameter. When skeletal type was compared with sellae size, a significant difference was found in the diameter of sellae between the Class II and Class III subjects (Alkofide et al., 2007; Andredaki et al., 2007). One of the reasons of variable dimension is that sellae turcica is housing the pituitary gland. However, any abnormality or pathology in the gland could manifest from an altered shape of the sella turcica (Pisaneschi et al., 2005; Ilyas, 2011). Radiological literature has reported a range from 4 to 12 mm for the vertical and 5 to 16 mm for the antero-posterior dimension of the sellae (Moffitt, 2011; Jones et al., 2005). Our measurements are in the above mentioned range as far as minimum and maximum values are concerned. Thus, the mean values are almost the same for each type of malocclusion. In contrast with our findings, other studies could not find a significant association between facial types and the mean size of pituitary fossa (Mahmood et al., 2011; Preston, 1979). Furthermore, the depth and diameter of sella turcica in class I, class II, and class III patients were relatively the same (Valizadeh, 2015).

In contrast with our results, other studies found normal morphology of pituitary fossa (Chauhan, 2014). Dysmorphologic types were more common in diabetic patients (Bavbek, 2014). Bridging and calcification of intracranial ligaments were found in various dental anomalies. Hence, this was considered to be highly suggestive of a genetic etiology which underlies these conditions. Palatally displaced canine and second mandibular premolar aplasia and dental transposition were conditions when bridging was found (Leonardi, 2006; Leonardi, 2011). The average shape of sella turcica is considered to be common among all the groups of the different skeletal pattern. Thus, no significant difference in mean sella turcica length, width, and height was found between the groups.

Conclusion

The orthodontist should be familiar with different morphologies of the sella turcica so as to differentiate normal from abnormal appearance. Most of the subjects (58.87%) presented round shaped sellae. In addition, skeletal class II cases presented the most anarchic sellae shapes. Statistically significant differences among linear skeletal parameters and sellae diameter were found in class I malocclusion (p=0.013). Comparing linear measurements of skeletal length and sellae diameter, we found that the smallest diameter of the sellae appears in class III malocclusions. However, other skeletal length present the lowest mean values also.

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