
ASSESSMENT OF THE MORPHOLOGICAL CHARACTERISTICS OF THE SELLA TURCICA IN RELATION TO THE OCCURRENCE OF DENTAL ANOMALIES

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Abstract: Sella turcica (ST) is one of the bony structures used as an indicator for predicting skeletal growth and development of dental and skeletal malocclusions in humans. The aim of this investigation is to assess the correlation between the morphological characteristics of the ST and the occurrence of dental anomalies.

Materials and methods: The study group comprised 109 patients (62 males and 47 females) aged 8-17 years. All subjects were evaluated cephalometrically. The dental anomalies (hypodontia, hyperdontia, palatally displaced canine, transposition and impaction of teeth) were determined by clinical and radiographic examination. The morphology of ST was estimated on a cephalometric x-ray through analysis of its length, depth and anteroposterior diameter. The results showed the presence of hypodontia in 52 subjects, the palatally displaced canine in 2, and a canine impaction only in 1 patient. A significant difference in the depth and anteroposterior diameter of ST ($p < 0.001$) were found between the groups with and without dental anomalies. There were no significant differences between groups for length values of ST.

Conclusion: Knowing the morphological characteristics of ST in a certain population is of great importance for taking early orthodontic treatment in order to prevent the occurrence of later severe disorders in the craniofacial complex. Orthodontists need to know the various morphologies of the ST to differentiate normal from abnormal appearance.

Keywords: sella turcica, dental anomalies, morphological characteristics, orthopantomogram, cephalometric x-ray

1. INTRODUCTION

In the orthodontic therapy, the exact time of starting orthodontic treatment is of particular importance, the goal of which is to establish normal occlusion and correct intercuspitation of the teeth, and results in a beautiful aesthetic appearance of the face. Orthodontic irregularities greatly affect the facial aesthetics, and through that the mental state of the individual, which reflects on the overall social life and success. Therefore, the time of starting the orthodontic therapy is of particular importance in order to enable appropriate orthodontic treatment. (Różyło-Kalinowska, I., Kolasa--Rączka, A. & Kalinowski, P. 2010). Predicting the direction and size of facial growth before the peak of pubertal growth is a valuable tool in assessing the type of skeletal disharmony and the possibility of its control in terms of functional possibilities. (Kolodziej, R., Southard, T., Southard, K., Casco, J. & Jakobsen, J. 2002). However, in different individuals, the period of craniofacial growth can hardly be determined because it depends not only on pubertal growth, but also on age, sex, hereditary traits, ethnicity, diet as and socioeconomic status. Early recognition of the development of skeletal malocclusions contributes to early conservative treatment with functional/orthopedic devices. (Baccetti, T., Franchi, L., Toth, L. & McNamara, J. 2000). However, the benefit of the analysis of these structures is not only in establishing the diagnosis, but also in monitoring the results of orthodontic treatment through the superimposition pattern of cephalometric x-ray images, which is a powerful tool for predicting growth over a longer period of time (Yasa, Y., Ocak, A., Bayraktar, I., Duman, S. & Gumussoy I. 2017). Sella Turcica (sella turcica - ST) is one of the bony structures that has been investigated as a possible indicator for predicting skeletal growth and development of dental and skeletal malocclusions in humans. It is a saddle-shaped bony depression located on the intracranial surface of the sphenoid bone. It has a front wall (tuberculum sellae), a back wall (dorsum sellae) and a floor, and the pituitary gland is located inside it. Deviation from the normal size and shape of the ST can be an indication of the presence of pathological conditions of the pituitary gland such as

intracellular primary tumors of the pituitary gland, hypopituitarism, Williams syndrome and Sheehan syndrome. (Andredaki, M., Koumantanou, A., Dorotheou, D. & Halazonetis, DJ. 2007). This emphasizes the importance of recognizing the abnormal shape of ST in the diagnosis of patients with these conditions. (Kjaer, I., Hjalgrim, H. & Russell, BG. 2001). In several studies (Pisaneschi, M. et al. 2005, Alkofide, E. 2001, Friedland, B. et al. 1996), cephalometric examinations in individuals with pathological conditions of the pituitary gland showed abnormalities in the form of ST and changes in regulation and level of glandular hormones. These changes can lead to growth disorders (acromegaly or gigantism), Cushing's syndrome, hyperthyroidism, and menstrual cycle disorders. (Elster, A. 1993). There are differences in linear and angular ST values depending on gender, age and ethnicity (Zagga, AD., Ahmed, H., Tadros, AA. & Saidu, SA. 2008). For this purpose, further investigations are needed regarding the morphology and shape of ST in the Macedonian population. In orthodontics, the analysis of cephalometric images is routinely used, so knowing the normal variations is of particular importance in the early recognition of abnormalities even before the appearance of any clinical manifestation. (Kjaer, I. et al 2001, Alkofide, EA. 2008). The aim of this paper is to determine if there is a correlation between the morphological characteristics of ST and the occurrence of dental anomalies.

2. MATERIAL AND METHOD

The examination was conducted on 109 subjects (62 male and 47 female subjects) aged 8-17 years, patients of the Department of Orthodontics at the University Dental Clinical Center in Skopje, Republic of Macedonia. An orthopantomogram, cephalometric x-ray of the craniofacial structures and intraoral photographs were performed in all subjects. Criteria for inclusion in the study were that the patients were between the ages of 8 and 17, had no previous orthodontic treatment, and had no history of tooth extraction. Based on the data, patients with a history of maxillofacial trauma and surgery, syndromes and systemic diseases, patients with congenital clefts of the mouth and palate, as well as patients on hormone therapy were not included in the study. After receiving written consent from the patient, a clinical examination and analysis of an orthopantomogram recording was performed to determine the dental anomalies. Lateral cephalometric x-ray was performed on the same cephalostat in all subjects and only those with clear ST reproduction were considered for further analysis. Through an intraoral clinical examination and analysis of an orthopantomographic images, an evaluation of dental anomalies was performed: hypodontia, hyperdontia, palatally displaced canine, transposition and impaction of teeth. The morphological characteristics of ST were determined according to Silverman's method (cited by Axelsson (2004)) by analyzing three parameters:

- ST length - linear distance between the tuberculum sellae and the top of the dorsum sellae;
- depth of the ST - normal from the deepest point of the floor of the ST to the line that joins the highest point of the tuberculum and dorsum sellae;
- anteroposterior diameter ST - distance from the tuberculum sellae to the most distal point of the posterior wall of ST.

Data analysis was performed in the statistical programs Statistica 7.1 for Windows and SPSS 23.0. Significance was determined at $p < 0.05$.

3. RESULTS

The results of the analysis of the data on the presence of dental anomalies on 109 subjects showed the presence of the dental anomaly hypodontia in 52 subjects, in 2 subjects the presence of a palatally displaced canine and in 1 patient an impaction of the maxillary canine was observed. The analysis of the ST length showed that the group without dental anomalies have a non-significantly higher value of this parameter compared to the subjects with hypodontia, while the group with hypodontia have a non-significantly greater length of the ST than the subjects with a palatally displaced canine (Tab. 1).

Table 1. Differences in ST length between groups of subjects with and without dental anomalies.

Depend:	1	2	4	6
ST length	R:59,59	R:51,25	R:16,75	R:78,50
No dental anomalies		1,00	0,36	1,00
Hypodontia	1,00		0,78	1,00
Palatally displaced canine	0,36	0,78		0,66
Impaction	1,00	1,00	0,66	

Multiple Comparisons p values (2-tailed)

The analysis of the ST depth values showed significantly higher values of this parameter in the group without dental anomalies compared to the subjects with hypodontia (Tab. 2 and 3).

Table 2. Depth of sella turcica in subjects with and without dental anomalies

Depend: ST depth	1 R:61,89	2 R:47,11	4 R:48,75	6 R:106,00
No dental anomalies		0,10	1,00	1,00
Hypodontia	0,10		1,00	0,39
Palatally displaced canine	1,00	1,00		0,84
Impaction	1,00	0,39	0,84	

Multiple Comparisons p values (2-tailed)

Table 3. Difference in the depth of sella turcica between the groups of subjects with hypodontia and without dental anomalies.

Variable	Rank Sum No dental anomalies	Rank Sum Hypodontia	U	Z adjusted	p-level	Valid N . No dental anomalies	Valid N Hypodontia
ST depth	3278,000	2393,000	1015,00	2,50	0,01	54	52

The analysis of the AP diameter values of ST showed statistically significant differences ($p < 0.01$) between the studied groups. Subjects without dental anomalies had a significantly larger AP diameter of ST compared to the group with hypodontia, while subjects with hypodontia had a non-significantly larger AP diameter compared to subjects with a palatally displaced canine. (Tab. 4)

Table 4. Differences in AP diameter of sella turcica between groups of subjects with and without dental anomalies.

Depend: AP diametar	1 R:65,86	2 R:44,49	4 R:22,25	6 R:80,50
No dental anomalies		0,003	0,33	1,00
Hypodontia	0,003		1,00	1,00
Palatally displaced canine	0,33	1,00		0,79
Impaction	1,00	1,00	0,79	

Multiple Comparisons p values (2-tailed)

4. DISCUSSION

ST as a significant anatomical structure in the craniofacial region is of particular importance in the analysis of cephalometric images in everyday routine orthodontic practice. A small number of studies can be found in the literature that examined the association between the morphological characteristics of the ST and the occurrence of dental and skeletal anomalies. In 2009, Afzal, E. & Fida, M. (2019) examining the association of dimensions and morphological variations of the ST with skeletal malocclusions in the sagittal direction, determined increased values of the depth and diameter of the ST in subjects with malocclusion class III, in contrast to subjects with malocclusion class II, where increased values of the length of this structure were determined. At the same time, in 50% of the subjects with class III malocclusion, the presence of the ST form with bridging was also determined. Examining the prevalence of ST anomalies in children with orthodontic malocclusions, Kucia, A., Jankowski, T., Siewniak, M., Janiszewska-Olszowska, J., Grocholewicz, K., Szych, Z. & Wilk, G. (2014) found significantly higher values of the angles of inclination of the incisors and retrograde position of the mandible in subjects with an abnormal form of ST compared to the control group. Shrestha, G., Pokharel, P., Gyawali, R., Bhattarai, B. & Giri, J. (2018) examining ST

shape in 40 orthodontic patients with various malocclusions, found increased ST length in individuals with malocclusion III class and increased prevalence of the bridging form in subjects with class II and III malocclusion compared to subjects in whom class I malocclusion was present. Shah, A., Bashir, U. & Ilyas, T. (2011) examining the shape and size of ST in patients with various malocclusions found that 66% of the subjects have a normal ST morphology and 34% have some deviation. Jankowski, T., Jedlinski, M., Grocholewicz, K. & Janiszewska-Olszowska, J. (2021) analyzed for the first time abnormal forms of ST in correlation with dental age and dental anomalies in Polish children. Their results showed an association between abnormal forms of ST and dental age, with a delay of 18 months in the studied group. Dental anomalies were more common in the group with irregularities in the morphology of the ST, in contrast to the control group, and the most common dental anomaly was hypodontia. The results of the tests carried out in this paper showed significantly lower values of the depth and AP diameter of the ST in the group of subjects with a dental anomaly hypodontia compared to the control group without dental anomalies which is in accordance with the findings of Kaya, Y., Öztaş, E., Goymen, M. & Keskin, S. (2021) who determined statistically significantly smaller dimensions of length and AP diameter of ST in the group of subjects with dental anomaly transposition of teeth compared to the group without dental anomalies, in contrast to the findings of Mortezaei, O., Rahimi, H., Tofangchiha, M., Radfar, S., Ranjbaran, M., Pagnoni, F. et al. (2023) who did not establish a relationship between ST dimensions and the occurrence of dental anomalies.

5. CONCLUSION

Knowing the morphological characteristics of ST in a certain population is of great importance for taking early preventive measures, but also early orthodontic treatment in order to prevent the occurrence of later more severe disorders in the craniofacial complex. Orthodontists need to know the different morphologic features of ST in order to distinguish normal from abnormal appearance.

Keywords: sella turcica, dental anomalies, morphological characteristics, orthopantomogram, ceph x-ray.

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