
EVALUATION OF THE MORPHOLOGICAL CHARACTERISTICS OF THE SELLA TURCICA WITH THE APPEARANCE OF SKELETAL MALOCCLUSIONS AND DENTAL ANOMALIES - A REVIEW

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Abstract: Aim of the study: The assessment of the dimensions and morphology of the sella turcica (ST) is of significance for the detection of some pathological processes in the human body. The purpose of this study is to verify, through the analysis of data from the available literature, whether there is a connection between the morphological characteristics of ST and the occurrence of natal anomalies and skeletal irregularities in the sagittal direction, as well as to show whether there is a correlation between the abnormal forms of this structure and dental age.

Material and method: To realize the overall research, an electronic search of published studies on this issue was conducted through the PubMed and Google Scholar databases. The literature search was done according to the PRISMA guidelines with the following main eligibility criteria: only studies published in English and studies throughout the human population.

Results: Five different abnormal morphological variations of ST were determined, of which the most frequently represented type is sella turcica with bridging. In the literature, large differences in the normal characteristics of ST between different populations are encountered due to the use of different points and radiographic techniques.

Conclusion: In the world literature, there are very few studies that examine the association of morphological characteristics of ST with the appearance of additional natal anomalies and skeletal malocclusions, as well as the correlation with dental age. The above studies indicate a positive correlation between abnormal forms of ST and the occurrence of dental anomalies and skeletal irregularities in the sagittal direction. In order to better shed light on this issue, it is necessary to conduct further research on this topic of obviously pathological conditions of the hypofysis.

Keywords: sella turcica, dental anomalies, skeletal malocclusions, dental age, and cephalometry.

1. INTRODUCTION

The aesthetic appearance of the face largely depends on the harmony of the craniofacial structures. The prediction of 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. 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 cefalometric x-ray images, which is a powerful tool for predicting growth over a longer period (Yasa, Y., Ocak, A., Bayrakdar, 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. According to the classification of Axelsson, S., Storhaug, K. & Kjaer, I. (2004), five different abnormal morphological variations of ST have been determined, of which the most common type is ST with bridging. Kucia, A., Jankowski, T., Siewniak, M., Janiszewska-Olszowska, J., Grocholewicz, K., Szych, Z. & Wilk, G. (2014), analyzing the form of ST in 322

children from Poland came to the conclusion that there are 3 more possible variations in the shape of the ST, namely, hypertrophic posterior clinoid processus - SD, hypertrophic posterior clinoid processus - SE and oblique floor shape of sella turcica - SJ. Analyzing the radiographs of 177 patients with pronounced craniofacial deformities, candidates for surgical treatment, Becktor, J., Einersen, S. & Kjær, I. (2000), determined that the most common abnormal form of ST is the bridging form. The same authors described this form as a fusion of the anterior and posterior clinoid extension and determined two types of bridging, A- manifest in the form of a strip and B extension-extension from the anterior or posterior extension of the clinoid bone. 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 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). The morphological appearance of ST is determined in the early stage of embryonic development (Kjær et al. 1998, Kjaer et al., 2002). A change in the form of ST recorded prenatally, and confirmed postnatally, was also observed in children with Down's syndrome (Kjær et al. 2001, Russell et al. 1999). According to Axelsson (2004), ST shape aberrations also occur in individuals with Williams syndrome. The abnormal size of ST is an indicator for further investigation of individuals in whom undetected diseases may exist. Friedland, B. & Meazzini, M. (1996) during a routine orthodontic analysis of a patient determined increased dimensions of the ST that were correlated with the presence of a pituitary prolactinoma, a benign tumor that was discovered by further investigations. Kjaer (2015), summarizing the research published in the world literature on the normal and pathological development of the ST and pituitary through histological analyzes of human prenatal material and profile radiographic analyzes of human postnatal material, supplemented in several cases with neuroradiology, concluded that deviations of the anterior wall are associated with deviations in the development of the frontonasal area, while deviations in the posterior wall are often associated with malformations of posterior structures such as changes in the cerebellum. In normal cases, small variations in morphology are observed, while in pathological cases, a specific pattern of malformations in ST morphology is observed, which varies with the appearance of a mild to severe phenotype. Kjaer (2015) also determined that the variations can include changes in the structure of the brainstem, thymus, thyroid gland, and heart (velocardiofacial syndrome), but can also be associated with malformations of the cerebellum and larynx (Cri-du- Chat syndrome). Through this review paper, the author highlights the value of combining profile radiographic diagnostics with neuroradiological diagnostics in cases with morphological changes of ST. The connection between the changes in the ST morphology and the appearance of dental anomalies is based on the common embryonic development of these structures. The study conducted by Jankowski, T., Jedlinski, M., Grocholewicz, K. & Janiszewska-Olszowska, J. (2021) clearly confirmed the association between dental anomalies and ST morphology on cephalometric X-rays. Several studies show changes in ST shape during craniofacial growth. Melsen (1974) determined that the apposition of bone on the anterior part of the inner surface of the ST reaches its peak at an early age, while resorption of the distal part of the floor and the posterior wall continues for a longer period. Variations in growth, however, depend on the interaction between genetic factors and environmental factors (Bajraktarova, 2000)

The purpose of this review paper was to determine, through the analysis of data from the available literature, whether there is a connection between the morphological characteristics of the ST and the appearance of dental anomalies and skeletal irregularities in the sagittal direction, as well as to determine whether there is a correlation between the abnormal forms of this structure and dental age.

2. MATERIAL AND METHOD

To realize the set goals, an electronic search of the PubMed and Google Scholar databases was conducted, using the following keywords and titles of medical topics: "sella turcica", "sella turcica and dental anomalies", "sella turcica and skeletal malocclusions" , "sella turcica and dental age" and "sella turcica and cephalometry". Published studies in the last 20 years were analyzed, except for a very small number of studies that are original and cited in all newer studies. The literature search was performed according to the PRISMA guidelines with the following main eligibility criteria: only studies published in English and studies conducted in human populations. Of particular interest were clinical studies, prospective and retrospective studies, and systematic reviews and meta-analyses.

3. DISCUSSION

The assessment of the dimensions and morphology of the ST is of great importance for the detection of possible pathological processes in the pituitary gland. Large differences in normal ST dimensions between different populations are found in the literature, which is likely due to the use of different points, radiographic techniques, and degree of radiographic expansion. Shah, A., Bashir, U. & Ilyas, T. (2011) examining the shape and size of the ST in patients with various malocclusions found that 66% of the subjects had normal morphology of the ST, and 34% had

some deviation. In a study performed on teleradiographs of patients with various dental anomalies, Leonardi, R., Barbato, E., Vichi, M. & Caltabiano, M. (2006) determined the presence of the abnormal form of bridging ST in 58.8% of the respondents. Leonardi, R., Farella, M. & Cobourne, M. (2011) examining the relationship between dental transposition and bridging ST form, found a high correlation between these two phenomena with the conclusion that determining the ST form in early childhood is a useful diagnostic tool for predicting the occurrence of dental anomalies in children. Scribante, A., Sfondrini, M., Cassani, M., Fraticelli, D., Beccari, S. & Gandini, P. (2017) also determined the association between the bridging ST form and dental anomalies which was also confirmed by Jankowski et al. (2021). Alqahtani (2020) examining the appearance of the form of ST with bridging in patients with hypodontia of the maxillary lateral incisor, concluded that the possibility of the appearance of this form is 2.5 times higher in these subjects compared to individuals with complete dentition. Ali, B., Shaikh, A. & Fida, M. (2014) found a significantly higher frequency of this form in patients with palatally impacted canines compared to the control group. In a study conducted among 765 subjects, Karaman, A., Cigerim, S. & Kechagia, N. (2021) determined that the degree of occurrence of dental anomalies hyperdontia, hypodontia, and dilaceration of the roots of the teeth were significantly more frequent in subjects with a form of ST with III degree of bridging compared to subjects with I degree, while the occurrence of taurodontism, unilateral and bilateral impaction of canines and impaction of other teeth is significantly less frequent in the group with I degree of bridging compared to subjects with II and III degree of bridging of ST. Several authors have investigated the relationship between the shape of ST with bridging and skeletal malocclusions in the sagittal direction, so Marsan, G. & Oztas E. (2009) found a higher incidence of bridging ST in patients with class III malocclusion which is consistent with the findings of Meyer-Marcotty, P. et al. (2010) and Sathyanarayana, H. et al. (2013). Filipović, G., Burić, M., Janošević, M. & Stošić, M. (2011) determining the size of ST through radiological analysis of 90 profile images of subjects with different malocclusions, determined that the smallest values of the linear dimensions of ST are observed in subjects with class II malocclusion and the highest values in patients with class III class, concluding that there is a high correlation between ST size and certain malocclusions. Meyer-Marcotty, P., Reuther, T. & Stellzig-Eisenhauer, A. (2010) in a retrospective study conducted on 400 lateral radiographs of adult patients, determined representation of the ST form with bridging in 16.8% of subjects with skeletal class III, compared to the group of respondents with class I, where the presence of this form was observed only in 9.4% of the respondents, which points to the possibility that this morphological form can be used as an indicator of the occurrence of malocclusion class III. Examining the prevalence of ST anomalies in children with orthodontic malocclusions, Kucia et al. (2014) found significantly higher values of incisor inclination angles and mandibular retrograde position in subjects with an abnormal shape of ST compared to the control group. In 2019, Afzal, E & Fida, M. examining the association of dimensions and morphological variations of ST with skeletal malocclusions in the sagittal direction, determined increased values of depth and diameter of ST in subjects with malocclusion class III in contrast to subjects with malocclusion II class, 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 form of ST with bridging was also determined. From a search of the available literature, only one study could be found that examined the association between ST morphology and dental age. Jankowski et al. (2021) for the first time analyzed 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 frequent in the group with irregularities in the morphology of ST, in contrast to the control group, and the most common dental anomaly was hypodontia. Dental anomalies were less prevalent in patients who had the bridging form of ST in contrast to other abnormal forms.

4. CONCLUSION

In the world literature, there are a small number of studies that examined the association of the morphological characteristics of ST with the occurrence of dental anomalies and skeletal malocclusions, as well as the correlation with dental age. These studies indicate a positive correlation between abnormal forms of ST and the occurrence of dental anomalies and skeletal irregularities in the sagittal direction. Deviations from the normal form of ST have different representations depending on the studied population. In order to better shed light on this problem, it is necessary to carry out further research on this topic, especially since these researches, as an additional effect, enables the detection of possible pathological conditions of the pituitary gland.

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