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Literature Review Article

The sella turcica: a brief review of the morphology analysis in dental research

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Abstract

Introduction: Sella turcica is an intracranial bone depression located in the sphenoid bone that houses the pituitary gland, which is an important gland in the secretion of various hormones. **Literature review:** Variations in the morphology of the sella turcica can alter the morphology of the pituitary, which can lead to changes in hormone secretion and dental anomalies. There are studies that evaluate the sella turcica using metric methods and other studies that evaluate them with non-metric methods. Researchers use lateral radiographs and/or computed tomography to visualize the sella turcica. The purpose of this brief review was to revise the methods used to study sella turcica morphology in dental research. The literature search for sella turcica morphology was carried out with the following key words (sella turcica, bridging of sella, size, shape of sella turcica and sella turcica morphology) and using the search engines (Pubmed and Google scholar). According to the research, three methods of analyzing the sella turcica were observed, according

to the measurements (length, width, diameter, area, depht, sella height posterior, sella height anterior), degree of calcification (class I / type I / group I, class II / type II / group II, class III / type III / group III) and format (normal sella turcica, sella turcica bridge type A – ribbon-like fusion, sella turcica bridge type B – extension of the clinoid processes, incomplete bridge, hypertrophic posterior clinoid process, hypotrophic posterior clinoid process, irregularity in the posterior part of the sella turcica, pyramidal shape of the dorsum sella, double contour of the floor, oblique anterior wall, oblique contour of the floor) of the sella turcica. **Conclusion:** It is expected that the three methods exposed in this review will help dental researchers to analyze sella turcica.

Introduction

Sella turcica is an intracranial bone depression located in the sphenoid bone that houses the pituitary gland, which is an important gland in the secretion of various hormones. The pituitary gland controls the function of most other endocrine glands and is called the master gland [19]. By detecting the levels of hormones produced by target glands under the pituitary's control, the hypothalamus or the pituitary gland can determine stimulation level that the target glands need [14].

The sella turcica morphology ranges according to the individuals and have been associated with a variety of conditions, including dental phenotypes such as dental transposition, tooth agenesis, supernumeraries tooth and impacted teeth [1-7, 9-11, 15, 17, 18], oral cleft [1, 2] and syndromes such as William's Syndrome, Cri du chat syndrome, Down's Syndrome among others [8, 16]. The s-point is one of the fix points used to determine the cranial base angle and the nasion–sella line connecting the nasion and the sella s-point. The accuracy or reproducibility of the s-point is crucial in orthodontic treatment and research.

The studies performing morphological analysis of the sella turcica have been using lateral cephalograms or computed tomography image to define the phenotypic variations. Leonardi *et al.* [15], Scribante *et al.* [18], Kaya *et al.* [11], Sato and Endo [17], Antonarakis *et al.* [2], Alam and Alfawzan [1] and Roomaney and Chetty [16] used lateral cephalograms to analyze the sella turcica. Hasan *et al.* [7], Islam *et al.* [9], Hasan *et al.* [8] and Roomaney and Chetty [16] used computed tomography to analyze the sella turcica.

Therefore, the purpose of this brief review was to revise the methods used to study sella turcica morphology in dental research. The literature search for sella turcica morphology was carried out with the following key words (sella turcica, bridging of sella, size, shape of sella turcica and sella turcica morphology) and using the search engines (Pubmed and Google scholar).

Sella turcica morphology

The phenotypic determination of the sella turcica ranged according to the study. Data on the size of the sella turcica have been well-reported in the dental literature. The size of sella turcica assessed from radiographs and computed tomography can be either linear or various methods of area and volume measurements. The linear measurements used by the studies and landmarkers, such as height/depth, anterior height, posterior height, diameter, length, area and width to assess the sella turcica of patients are described in the table I.

Some studies classified the sella turcica according to the calcification of the clinoid processes. Leonardi *et al.* [15], Scribante *et al.* [18], Antonarakis *et al.* [2], Kaya *et al.* [11] and Sato and Endo [17] classified in Class I / Type I (no calcification): the length was greater than three-quarters of the diameter; class II / type II (partially calcified): the length was less than or equal to three quarters of the diameter; and Class III / type III for a radiographically visible diaphragm sella. This is described in the table II.

Sella turcica is also evaluated according to the its shape as normal sella turcica, sella turcica bridge type A – ribbon-like fusion, sella turcica bridge type B – extension of the clinoid processes, incomplete bridge, hypertrophic posterior clinoid process, hypotrophic posterior clinoid process, irregularity (notching) in the posterior part of the sella turcica, pyramidal shape of the dorsum sella, double contour of the floor, oblique anterior wall, oblique contour of the floor. The table III describes the studies that evaluated sella turcica shape. The morphological variation is shown in figure 1.

Table I – Linear and area measurements description

Measurements	Description	Reference
Length	Distance between the dorsum sella (DS) and the tuberculum sella (TS)	Leonardi *et al.* [15]; Scribante *et al.* [18]; Kaya *et al.* [11]; Islam *et al.* [9]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]; Sato and Endo [17]; Baidas *et al.* [3]
Diameter	Distance between the tuberculum sella to the most posterior point on the inner wall of the pituitary fossa	Leonardi *et al.* [15]; Scribante *et al.* [18]; Kaya *et al.* [11]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]; Sato and Endo [17]; Islam *et al.* [9]; Baidas *et al.* [3]
Width	Distance between the point most posterior (SP) and the point most anterior (SA) perpendicular to the Frankfort plane (FH)	Antonarakis *et al.* [2]; Islam *et al.* [9]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]
Sella height posterior	Distance between DS and deepest point (SF), perpendicular to FH	Antonarakis *et al.* [2]; Islam *et al.* [9]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]
Sella height anterior	Distance between tuberculum sella and SF, perpendicular to FH	Antonarakis *et al.* [2]; Islam *et al.* [9]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]
Depth / Sella height median	Distance between midpoint clinoid process DS and TS to SF, perpendicular to FH	Scribante *et al.* [18]; Antonarakis *et al.* [2]; Islam *et al.* [9]; Hasan *et al.* [7]; Hasan *et al.* [8]; Alam and Alfawzan [1]; Kaya *et al.* [11]; Sato and Endo [17]; Baidas *et al.* [3]
Area	TS – SA – SF – SP – DS	Antonarakis *et al.* [2]; Hasan *et al.* [7]; Hasan *et al.* [8]; Islam *et al.* [9]; Alam and Alfawzan [1]; Sato and Endo [17]

Table II – Sella turcica classification according to the calcification of the clinoid processes

Type of sella	Description	Reference
Class I / type I / Group I (no calcification)	the length was greater than three-quarters of the diameter	Leonardi *et al.* [15]; Scribante *et al.* [18]; Antonarakis *et al.* [2]; Kaya *et al.* [11]; Sato and Endo [17]
Class II / type II / Group II (partial calcified)	the length was less than or equal to three quarters of the diameter	Leonardi *et al.* [15]; Scribante *et al.* [18]; Antonarakis *et al.* [2]; Kaya *et al.* [11]; Sato and Endo [17]
Class III / type III / Group III	radiographically visible diaphragm sella	Leonardi *et al.* [15]; Scribante *et al.* [18]; Antonarakis *et al.* [2]; Kaya *et al.* [11]; Sato and Endo [17]

Table III – Sella turcica's shape

Shape of the sella turcica	Author
Normal sella turcica	Kucia *et al.* [13]; Islam *et al.* [9]
Sella turcica bridge type A – ribbon-like fusion	Kucia *et al.* [13]
Sella turcica bridge type B – extension of the clinoid processes	Kucia *et al.* [13]
Hypertrophic posterior clinoid process	Kucia *et al.* [13]
Hypotrophic posterior clinoid process	Kucia *et al.* [13]
Pyramidal shape of the dorsum sellae	Kucia *et al.* [13]; Islam *et al.* [9]
Oblique contour of the floor	Kucia *et al.* [13]
Oblique anterior wall	Kucia *et al.* [13]; Islam *et al.* [9]
Double contour of the floor	Kucia *et al.* [13]; Islam *et al.* [9]
Irregularity (notching) in the posterior part of the sella turcica	Kucia *et al.* [13]; Islam *et al.* [9]
Incomplete bridge	Kucia *et al.* [13]
Sella turcia bridge	Islam *et al.* [9]; Alam and Alfawzan [1]; Leonardi *et al.* [15]; Scribante *et al.* [18]; Antonarakis *et al.* [2]; Kaya *et al.* [11]; Sato and Endo [17]

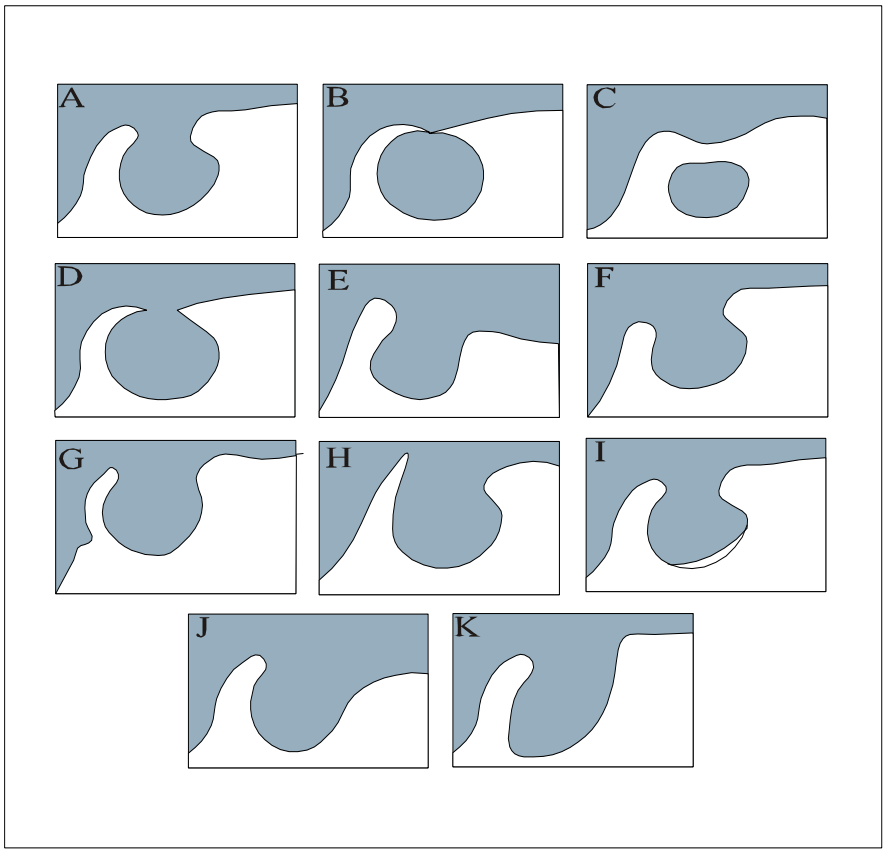

Figure 1 – A) normal sella turcica; B) sella turcica bridge type B – extension of the clinoid processes; C) sella turcica bridge type A – ribbon-like fusion; D) incomplete bridge; E) hypertrophic posterior clinoid process; F) hypotrophic posterior clinoid process; G) irregularity (notching) in the posterior part of the sella turcica; H) pyramidal shape of the dorsum sella; I) double contour of the floor; J) oblique anterior wall; K) oblique contour of the floor

Final considerations and future directions

The sella turcica is an important anatomical reference in the orthodontic field. The s-point, which is placed centrally in the sella region, is a central fix point in cephalometric analysis and partly because the contour of the anterior wall is used in the analysis of the craniofacial growth [12]. However, it is possible that the sella turcica is also a valuable marker to predict dental anomalies and, therefore, the knowledge regarding its morphology and the association with other developmental alteration is important in future studies, specially in dental research.

Recent original studies [1-3, 5-9, 11, 15, 17, 18] and systematic reviews [4, 10 16] that investigated the relationship between sella turcica morphology and dental anomalies concluded that developmental dental alterations are associated with specific types of sella turcica phenotypes. Jankowski *et al.* [10] in a systematic review concluded that there is an association between dental abnormalities (palatally displaced canines and tooth agenesis) and sella turcica bridge. The authors used cephalometric radiographs and computed tomography to investigate sella turcica morphology. Brasil *et al.* [4] also performed a recent systematic review and also concluded that patients with tooth agenesis and patients with oral clefts are more likely to have alterations in the morphology of the sella turcica. Although these studies and reviews clearly supported that craniofacial developmental alterations are associated with sella turcica morphological variations, more studies with larger sample size are necessary.

In conclusion, morphological variations of the sella turcica may be indicative of some craniofacial developmental alterations, such as dental anomalies (tooth agenesis, tooth transposition, dental impaction, supernumerary tooth) and oral cleft. Therefore, dental researchers in this area should be aware of the methods used to investigate sella turcica morphology.

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