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Sella Turcica Bridging - A Diagnostic Aid In Orthodontics

Author

Abstract
Introduction:
The sella turcica, a saddle-shaped depression in the sphenoid bone housing the pituitary gland, may present with morphological variations such as sella turcica bridging due to excessive ossification between the anterior and posterior clinoid processes. Sella turcica bridging is associated with various skeletal and systemic conditions, with a reported prevalence of 3.6% to 13%. This study aimed to assess and compare the incidence of sella turcica bridging and its dimensions in patients with Class I, II, and III skeletal patterns.
Materials and methods:
This study compared sella turcica dimensions across individuals with skeletal Class I, II, and III malocclusions. Sella length was measured and statistical analysis was performed to evaluate differences among groups, along with correlations between sella turcica bridging, age, and gender.
Results:
A significant difference ($p < 0.05$) in sella length was observed among the groups, with the Class III group showing the shortest length and Class I group the longest. No significant correlation was found between sella turcica bridging occurrence and age or gender ($p > 0.05$).
Conclusion:
Sella turcica bridging incidence is independent of age and gender but is associated with variations in sella morphology across skeletal classes, particularly shorter sella length in Class III malocclusions.
Keywords: *sella turcica bridging, cephalometric analysis, craniofacial skeletal patterns, orthodontic diagnosis*

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I. Introduction:

The sella turcica, a saddle-shaped depression within the sphenoid bone, houses the pituitary gland. Sella bridging, a common morphological variation, arises from excessive ossification of the ligaments between the anterior and posterior clinoid processes, often linked to abnormal foetal development.[1] This anomaly is associated with various skeletal and systemic disorders. The occurrence of sella turcica bridging in the general population ranges from 3.6% to 13%.[2]

Lateral cephalometric radiographs, commonly used in orthodontics, can also reveal diagnostic information about the skull, face, and upper cervical spine. Anatomic anomalies of the sella turcica can be used for interpretation of lateral cephalometric radiographs. Neural crest cells contribute to the formation and development of the sella turcica, teeth, and all parts of the face, there may be a relationship with the abnormalities of this area.[3] Studies by Bector, Jones, Leonardi & Alkofide have explored the relationship between sella turcica variations and various syndromes, skeletal patterns, and dental anomalies using these radiographs.[4,5] Batool Ali concluded that the incidence of sella turcica bridging was higher in patients with latent canines.[6] In orthodontics, craniofacial skeletal types are classified into three groups based on the sagittal relationship of the maxilla and mandible (Class I, II, III), which aids in identifying and treating patients. This study aims to assess and compare the incidence of sella turcica bridging and its dimensions in patients with Class I, II, and III skeletal patterns.

II. Methodology:

It was a retrospective study where the lateral cephalograms of the patient who had visited our department were collected. 30 lateral cephalometric radiographs, comprising 10 cases from each skeletal class (I, II, and III), were analyzed. Patients were classified based on the sagittal skeletal relationship using the ANB angle according to Steiner: Class I (ANB ±2°), Class II (ANB > 4°), and Class III (ANB < 0°).[7]

NemoCeph software was employed to measure the sella turcica's length, diameter, and depth.(Figure 1-2) Radiographic images were calibrated, and cephalometric tracings were performed to identify four key points on the sella turcica: the tuberculum sella (TS), dorsum sella, the farthest point on the inner wall, and the deepest point of the sella floor. These points were used to calculate the sella's dimensions: length (TS to dorsum sella), diameter (TS to the farthest point on the inner wall), and depth (distance from the interclinoidal line to the deepest point).

Sella turcica bridging was assessed using a modified Leonardi technique, which classifies bridging into three categories: Class I (length > ¾ of diameter, no calcification), Class II (length < ¾ of diameter, partial calcification), and Class III (distance between clinoid processes < 1 mm, or full calcification).[3]

ANOVA was used for assessing the relationship between the dimensions of the sella turcica and craniofacial skeleton classification. The Pearson's correlation coefficient was used for assessing the relationship between age & sex and sella bridging .

III. Results:

The descriptive data of the study is mentioned in the Tables 1

Significant Difference was found between the groups ($p<0.05$) in sella length between the three groups with class III group having the shortest sella length and class I group having the greatest sella length. (Table 2)

There was a significant positive correlation observed between the Skeletal craniofacial types classified according to the ANB angle by Steiner and Sella Turcica Bridging. (Table 3)

No significant difference was seen in sella depth and sella diameter between the three groups. (Table 4 and Table 5)

There was no significant correlation observed between Age and Sella Turcica Bridging and also between Gender and Sella Turcica Bridging ($p>0.05$)

IV. Discussion:

Dental epithelial progenitor cells and maxillary, palatal, and frontonasal developmental fields share a common embryologic origin with the anterior wall of the sella turcica, which is the predominant derivative of neural crest cells. Neural crest cells influence neck and shoulder development, sella turcica calcification, and tooth formation and eruption. From this point of view, the morphologic variations and appearance of the sella turcica, which are established early in embryonic development, may be associated with dental anomalies. The findings of this study reinforce the role of sella turcica bridging as a developmental anomaly, with notable implications for orthodontic diagnosis. The results indicate a significant relationship between sella length and craniofacial skeletal patterns, with shorter sella lengths observed in Class III individuals. This finding is consistent with studies suggesting that sella turcica morphology may be influenced by craniofacial development.[8]

This study highlights key novel findings on the relationship between craniofacial skeletal classifications and sella turcica morphology, offering important implications for orthodontic diagnostics and future research.

The significant difference in sella length among the skeletal groups with the Class III group exhibiting the shortest and the Class I group the greatest sella length illustrates distinct morphological variations associated with craniofacial patterns. This finding supports the concept that sella turcica dimensions are influenced by the underlying skeletal structure, aligning with anatomical and developmental principles. Moreover, the significant positive correlation between skeletal types classified by the ANB angle and sella turcica bridging suggests that bridging morphology may serve as a valuable indicator linked to craniofacial skeletal differentiation.

These findings extend existing knowledge by reinforcing sella turcica bridging as a potential morphological marker for distinguishing between different skeletal classes. This insight provides a foundation for future studies to explore the developmental origins and genetic factors underlying these variations, which could refine orthodontic diagnostic protocols and deepen the understanding of craniofacial anomalies.

Alkofidde reported a significant relationship between class II or III skeletal patterns and the diameter of sella turcica. He found that greater diameters of sella turcica was seen in skeletal Class III malocclusion and smaller diameters of sella turcica was seen in skeletal Class II Malocclusion.[5]

Shrestha et al found significantly greater lengths and diameters in subjects with skeletal Class III malocclusion than in subjects with skeletal Class I and Class II malocclusion.[9]

Magat et al found a greater diameter size of the sella turcica in females than in males.[10] In contrast, Axelsson et al observed greater lengths of the sella turcica in males than in females.[11]

Longitudinal data regarding the changes in the size of the sella turcica during growth show that the anterior wall appears stable, whereas the posterior wall undergoes resorptive changes.

Limitations of this study include the sample size and its cross-sectional design, which preclude definitive conclusions about developmental changes or causality. Longitudinal investigations with larger and more diverse cohorts will be valuable to verify the observed associations and assess their temporal dynamics.

In summary, this study contributes important new evidence that sella turcica length and bridging morphology relate to skeletal craniofacial types. These anatomical features have the potential to complement existing cephalometric analyses and enhance orthodontic diagnostic accuracy. Future research should aim to validate these findings across populations and explore their implications for clinical practice and craniofacial developmental biology.

V. Conclusion:

There is a significant relationship between sella length and craniofacial types with the class III individuals having the shortest sella length and class I individuals having the greatest sella length. Furthermore, as the ANB angle increased, sella turcica bridging also increased. Therefore anatomic variations in sella turcica can be used as a diagnostic aid in Orthodontics.

Conflict Of Interest:
The authors declare that there is no conflict of interest.

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Not applicable

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The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contribution:
Author SC: Conceptualization, Methodology, Investigation, Software, Resources, Writing – Original Draft
Author HV: Conceptualization, Data Curation, Formal Analysis, Writing – Review & Editing
Author HKP: Supervision, Project Administration, Writing – Review & Editing

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Tables

Table 1 Showing Descriptive Data Of Age, Sella Bridge And Gender

AGE (Mean±SD)		19.10±3.438
SELLA BRIDGE (Mean±SD)		1.67±0.479
GENDER n(%)	MALES	13(43.3%)
	FEMALES	17(56.7%)

Table 2 Comparing Sella Length In Class I, Class Ii And Class Iii Patients

Anova

SELLA LENGTH	Occlusion	N	Mean	Std. Deviation	Confidence Interval		p value
					Lower Bound	Upper Bound	
	Class1	10	6.9310	1.57487	5.8044	8.0576	0.000
	class2	10	5.4470	0.53508	5.0642	5.8298	
	class3	10	4.0080	0.91400	3.3542	4.6618	

Table 3 - Correlation Between Anb Angle And Sella Turcica

Spearman's Correlation was used to correlate between Angle's Occlusion and Sella Turcica Bridging. There was a significant positive correlation observed ($p<0.05$)

BRIDGING

			SELLA BRIDGE
Spearman's rho	ANB Angle	Correlation Coefficient	0.520
		Sig. (2-tailed)	0.003
		N	30

TABLE 4 COMPARING SELLA DIAMETER IN CLASS I, CLASS II AND CLASS III PATIENTS

SELLA DIAMETER	Occlusion	N	Mean	Std. Deviation	Confidence Interval		p value
					Lower Bound	Upper Bound	
	Class1	10	8.739	1.67296	7.5422	9.9358	0.624
	class2	10	8.259	1.86333	6.9261	9.5919	
	class3	10	8.080	0.99137	7.3708	8.7892	

Compared using One Way ANOVA. No Significant Difference was found between the groups ($p>0.05$).

TABLE 5 COMPARING SELLA DEPTH IN CLASS I, CLASS II AND CLASS III PATIENTS

SELLA DEPTH	Occlusion	N	Mean	Std. Deviation	Confidence Interval		p value
					Lower Bound	Upper Bound	
	Class1	10	7.0070	1.00445	6.2885	7.7255	0.462
	class2	10	6.8820	1.30615	5.9476	7.8164	
	class3	10	6.3320	1.46768	5.2821	7.3819	

Compared using One Way ANOVA. No Significant Difference was found between the groups ($p>0.05$)