ASSOCIATION BETWEEN SHAPE OF SELLA TURCICA AND CLASS OF MALOCCLUSION

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ABSTRACT

The sella turcica, a saddle-shaped depression in the sphenoid bone, houses the pituitary gland and shares a common embryonic origin with teeth and facial structures, making it a valuable tool in orthodontic diagnosis and treatment planning. This study aims to analyse the association between sella turcica morphology and malocclusion using lateral cephalograms. A hospital-based cross-sectional study was conducted at the Department of Orthodontics, Mahatma Gandhi Dental College and Hospital, Jaipur, India. A total of 137 pre-treatment lateral cephalograms of patients aged 10 to 30 years were included in the study. The morphology of the sella turcica was assessed using Axelsson's classification, and malocclusion was categorized using Angle's classification. Statistical analysis was performed using descriptive statistics and the chi-square test, with SPSS version 27. Among the 137 cephalograms analysed, the normal shape of the Sella turcica was the most prevalent (n=55), followed by pyramidal (n=30) and oblique (n=20) shapes. Bridging (n=6) and irregular (n=12) shapes were the least observed. The results suggest an association between certain Sella turcica shapes and specific types of malocclusions. The findings of this study highlight the potential of lateral cephalograms for early diagnosis and intervention in patients with malocclusion, especially in cases with abnormal Sella turcica morphology. Identifying such associations could aid in improving orthodontic treatment outcomes.

KEYWORDS

Morphology, sella turcica, malocclusion, lateral cephalogram, orthodontic diagnosis

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INTRODUCTION

Various landmarks within the cranium have been identified as essential reference points for tracing cephalometric radiographs.[1] These points are utilized to measure the positions of structures, such as the maxilla and mandible, in relation to the cranium or to each other.[2] The study of these structures provides numerous advantages, including aiding in the diagnosis of orthodontic cases, monitoring individual growth through the superimposition of structures over time, and assessing the results of orthodontic treatment.[3,4] The sella point, located at the midpoint of the Sella turcica, is a key reference in cephalometric studies.[5] The sella turcica is a saddle-shaped depression on the sphenoid bone that houses the pituitary gland and is situated between the clinoid processes, consisting of the tuberculum sellae, pituitary fossa, and dorsum sellae.[6,7] The pituitary gland develops at a faster rate than the sella turcica, leading to its completion before the sella turcica is fully formed. As a result, any pathological changes occurring in the pituitary gland during this period can influence the morphology of the sella turcica.[8] Any abnormalities in the pituitary gland's development may result in corresponding changes in the sella turcica's morphology.[9] The anterior portion develops from neural crest cells, independent of the notochord, while the posterior part forms from the paraxial mesoderm, which relies on the notochord.[10] Abnormalities in the anterior sellar wall may be associated with frontonasal defects, whereas those in the posterior wall are often linked to brain malformations.[9]

Axelsson[5] in a study on Norwegian population, classified morphology of Sella turcica into six distinct types which includes the normal form, oblique anterior wall, double contour of the Sella floor, irregular posterior dorsum Sella, Sella bridging and pyramidal shape of the dorsum sella. Due to its involvement in neural crest cell migration, the sella turcica significantly influences dentition and facial development, underscoring its importance in orthodontics.[11,12] Additionally, it plays a key role in cephalometric analyses, aiding in diagnosis, treatment planning, and tracking patient growth and treatment outcomes through structural superimposition.[4] Hence, This study aims to analyse the association between Sella turcica morphology across different skeletal patterns using cephalometric analysis, enhancing understanding for improved orthodontic diagnosis and treatment planning.

MATERIALS AND METHODS

This cross-sectional study was conducted at Mahatma Gandhi Dental College and Hospital (MGDCH), Jaipur, India, after obtaining approval from the Institutional Ethical Committee. The study was carried out from October 2019 to December 2019, and the sample was selected from patients who sought treatment at the Department of Orthodontics, MGDCH, Jaipur, India. A total of 200 lateral cephalograms were initially reviewed, from which 137 high-quality pre-treatment cephalograms were selected based on specific eligibility criteria. These cephalograms were taken by trained radiographic technicians using a standardized cephalostat to ensure consistency. Only lateral cephalograms with clear visibility of all cephalometric structures, with a particular focus on the dorsum sellae and tuberculum sellae, were included in the analysis. Patients aged between 10 to 30 years were included in the study. Patients with cleft lip and palate or medical conditions and syndromes affecting the craniofacial skeleton that could alter the size and shape of the Sella turcica were excluded from the study. Also, cephalograms of poor quality or with unclear visualization of the sella turcica were excluded from the study.

Each cephalogram was analysed by a single investigator to assess the morphology of the sella turcica using Axelsson's classification system.[5] Records were used to obtain data on the gender and age of individual at the time of lateral cephalogram. The malocclusion type was determined based on Angle's classification.

Statistical Analysis: This was performed using SPSS-27. Based on the age of the individuals were grouped into two groups. All variables were qualitative and expressed as frequency and percentage. Cross tabulation was done with shape of sella turcica as the dependent variable and chi-square was also used. A level of p value <0.05 was considered statistically significant.

RESULTS

The study analysed 200 lateral cephalograms out of which 137 were selected based on eligibility criteria. The study participants belonging to the age group of 10-30 years were selected (Table 1). Out of these, 66 participants (48.2%) were female and 71 (51.8%) were male. The results indicated no significant association between sella turcica shape and gender (p-value = 0.824) (Table 1).

Table 1: Frequency distribution of different shapes of sella turcica among two age groups and gender

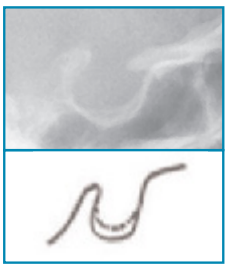
Sella turcica shape	10-20 years n (%)	21-30 years n (%)	Female n (%)	Male n (%)
Normal Sella turcica	25 (18.2)	33 (24.1)	28 (20.4)	30 (21.9)
Oblique anterior wall	9 (6.6)	11 (8.0)	9 (6.6)	11 (8.0)
Double contour of Floor	4 (2.9)	7 (5.1)	4 (4.4)	5 (3.6)
Irregularity in posterior part of Sella turcica	4(2.9)	8 (5.8)	4 (2.9)	8 (5.8)
Sella turcica Bridging	0 (0.0)	6 (4.4)	4 (2.9)	2 (1.5)
Pyramidal shape of dorsum sellae	13 (9.5)	17 (12.4)	15 (10.9)	15 (10.9)
Total	**55 (40.1)**	**82 (59.9)**	**66 (48.2)**	**71 (51.8)**
Chi Square Test	p = 0.434: Not Sig		p = 0.824: Not Sig	

Table 2: Frequency distribution of different shapes of sella turcica in class I, II, III malocclusion

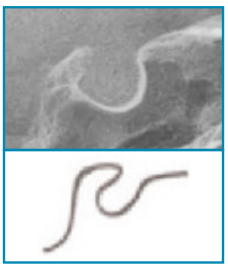
Sella turcica shape	Malocclusion							
	Class I		Class II		Class III		Total	
	n	%	n	%	n	%	n	%
Normal sella turcica	33	24.1	20	14.6	5	3.6	58	42.3
Oblique anterior wall	13	9.5	6	4.4	1	0.7	20	14.6
Double contour of floor	6	4.4	3	2.2	2	1.5	11	8.0
Irregularity in posterior part of sella turica	3	2.2	6	4.4	3	2.2	12	8.8
Sella turica bridging	3	2.2	2	1.5	1	0.7	6	4.4
Pyramidal shape of dorsum sellae	11	8.0	10	7.3	9	6.6	30	21.9
Total	**69**	**50.4**	**47**	**34.3**	**21**	**15.3**	**137**	**100.0**
Chi Square Test	p = 0.209: Not Significant							

1.a: Normal sella turcica

1.b: Oblique anterior wall

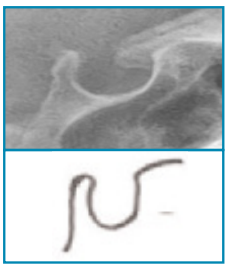


1.c: Double contour of the floor



1.d: Irregularity in posterior part of Sella turcica

1.e: Sella turcica Bridging



1.f: Pyramidal shape of dorsum sellae

Fig. 1: Showing different shapes on sella turcica in lateral cephalograms

The normal sella turcica shape was the most common, found in 42.3% of cases, with the highest prevalence in Class I malocclusion (24.1%). The pyramidal shape was seen in 21.9% of cases, primarily among individuals with Class III malocclusion. The oblique anterior wall was present in 14.6% of cases, predominantly in Class I malocclusion. Double contour, irregular shapes, and bridging were observed less frequently, mainly in Class I and II malocclusions. The results indicated no statistically significant association between sella turcica shape and the different malocclusion classes (p =0.209) (Table 2).

DISCUSSION

In this study, classification of Sella turcica shapes established by Axelsson[5] was utilized, while noting that other researchers, such as Norton and Kantor,[13] as well as Bell and Gordon,[14] have identified various morphological variations in this anatomical structure. Bell and Gordon[14] examined radiographs of children aged 1 to 12 years and categorized sella turcica shapes into three primary types: saucer-shaped, oval, and circular, with oval and circular shapes being the most frequently observed. According to the Axelsson[5] classification employed in current research, the normal shape of the Sella turcica emerged as the predominant morphology across the three classes of malocclusion. Additionally, the significant presence of oblique anterior walls and pyramidal shapes underscores their relevance in cephalometric analysis. Other studies have also documented a range of sella turcica shapes; for instance, research by Islam *et al*[15] found that normal Sella turcica accounted for 69.2% of the population, while irregular shapes were the second most common at 16.2%. Baidas *et al*[16] reported that normal Sella turcica was present in 56.4% of their subjects, with irregular dorsum sellae observed in 17.2%, and the least common shape being an oblique anterior wall at 5.2%, which contrasts with our findings. Alkofide *et al*[4] noted that 67% of Saudi subjects exhibited normal shapes, while 33% demonstrated variations. Bridging of the Sella turcica, characterized by the fusion of the anterior and posterior clinoid processes, is an anatomical abnormality often linked to skeletal and dental malformations, as well as various syndromes. In current research, incidence of mandibular impacted canines was identified in one lateral cephalogram with class I malocclusion associated with Sella turcica bridging. Research indicates that Sella turcica bridging occurs in 5.5% to 22% of individuals in the normal population.[5] For instance, Becktor *et al*[17] analysed 177 lateral cephalometric radiographs and found sella turcica bridging in 18.6% of their subjects.[17] In current research, a lower prevalence of sella turcica bridging (4.4%) was observed within the study population. This highlights the variability of sella turcica morphology and its potential clinical implications in orthodontic practice. The current investigation has several limitations, including a relatively small sample size of 137, which may reduce statistical power and limit the generalizability of the results. Furthermore, the study's focus solely on the sella turcica may exclude other key craniofacial structures that could also play a role in influencing malocclusion. Future studies including larger sample size and advanced imaging technique like CBCT can improve the accuracy of results.

The study highlights the notable prevalence of various sella turcica shapes among patients with different malocclusion classes, underscoring their clinical significance in orthodontics. Although no statistically significant association was found between sella turcica shape and malocclusion classes (p-value = 0.209), the potential implications of rare occurrences like sella turcica bridging for certain craniofacial conditions should not be underestimated. These findings suggest that understanding sella turcica morphology can enhance diagnostic approaches and treatment strategies in orthodontic practice.

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