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ANALYSING THE MORPHOLOGICAL VARIATIONS OF SELLA TURCICA IN DIGITAL LATERAL CEPHALOGRAM-A RETROSPECTIVE STUDY

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ABSTRACT

The Sella Turcica is saddle shape bony area located in the middle cranial fossa that lodges the pituitary gland. It is an important anatomical structure and a central bony landmark in Cephalometric assessment. The changes in size of Sella Turcica often related to pathology or syndromes. **AIM:** The purpose of the present study is to measure the size of Sella Turcica in different age groups and to describe it's morphology in lateral cephalograms. **OBJECTIVES:** To measure the shape of Sella Turcica and establish normative reference standards of Sella Turcica that assists in more objective evaluation and detection of pathological conditions. Abnormal morphology of Sella Turcica provide insight to examine patients suffering from pathological conditions related to pituitary gland. **MATERIALS AND METHODS:** The sample includes lateral cephalogram of 40 participants of age group 21-65 years which is grouped into four groups based on age of the participant ;group I-age group 21-30, group II-31-40, group III -age group 41-50, group IV – age group 51-60 and analysed digitally. Morphological appearance of Sella Turcica is assessed and classified based on Axelsson's et al classification of Sella Turcica. **RESULTS:** Six morphological variations of Sella Turcica were found. All the linear measurements of Sella Turcica were within standard range. Linear measurements of Sella Turcica were not found to significantly correlate with age. **CONCLUSION:** If abnormal morphology is found, patients can be subjected to advanced imaging modalities such as CT or MRI for confirming pathology.

KEYWORDS : Lateral cephalograms, Sella Turcica, Hypophyseal fossa, Morphometry, Cephalometric measurements.

INTRODUCTION

Sella Turcica is an Important anatomical structure. Sella Turcica is derived from Latin; Sella means Saddle and Turcica means Turkish. It is named so due to its resemblance to saddle used by Turks. Anatomically, Sella Turcica is a Saddle shape bony concavity located in middle cranial fossa. It lies in intracranial surface of body of sphenoid. It is bounded anteriorly by Tuberculum Sella and posteriorly by Sella. It has two anterior clinoid process, two posterior clinoid process and a central pituitary fossa. The 2 anterior & 2 posterior clinoid process project over Pituitary fossa. The central pituitary fossa lodges the Master gland, the Pituitary gland[1]

The development of the Sella Turcica is strictly associated with the development of the pituitary gland. The prenatal and postnatal developments of the Sella Turcica and pituitary gland are interrelated since the formation of the pituitary gland must be completed before the Sella Turcica can be created. Pituitary organogenesis starts at the 4th week of foetal development. The pituitary is an organ of dual origin. The anterior lobe (Adenohypophysis) is derived from oral ectoderm and is epithelial in origin, whereas the posterior lobe (Neurohypophysis) is derived from the neural ectoderm. Thus, anomalies of the gland modify the sellar morphology and shape anomalies of the Sella Turcica may both be accompanied by functional disorders in the pituitary gland and by morphological abnormalities of the facial bones. [2]

Lateral cephalometric radiography is an extraoral radiographic technique that unveils many craniofacial and oral structures. This projection demonstrates the bones of the face, skull as well as the soft tissue profile of the face. This view is used to evaluate facial growth and development, trauma, disease, and developmental anomalies.

The Sella Turcica can be well appreciated on lateral cephalometric radiographs and is a central landmark in cephalometric assessment. The centre of Sella Turcica is used as a cephalometric landmark to act as a reference point for evaluating the spatial position of both jaws as they relate to the cranial base. The lateral cephalometric radiograph provides a good source of additional diagnostic information related to the pathology of the hypophysis, or to various syndromes that affect the craniofacial region.[3]

The size and morphology of Sella Turcica vary from person to person. The anteroposterior diameter of Sella Turcica ranges from 5 to 16 mm and the vertical depth ranges from 4 to 12 mm. [2] Changes in size and shape of the Sella Turcica are frequently related to pathology and syndromes associated with the pituitary gland. The abnormal morphology of the Sella Turcica may provide insight into examining patients suffering from these conditions, even before they are clinically evident.

Sella Turcica enlargement may be an indication of a pituitary tumour overproducing hormones such as an adrenocorticotropic hormone, prolactin, growth hormone, thyroid stimulating hormone, and antidiuretic hormone. Enlargement is the most frequent finding but is usually not accompanied by bone erosion. An abnormally small Sella Is less likely to occur. It is seen in primary hypopituitarism, growth hormone deficiency, and Williams syndrome. [1]

Any morphological variations incidentally found in this area can be a leading method to further investigate a variety of pathological situations that may be undiagnosed or subclinical. Thus, obtaining any data in this regard will be a great help in detecting abnormalities within this anatomic area.

AIM AND OBJECTIVES

The purpose of the present study is to measure the size of Sella Turcica in different age groups, to describe it's morphology in Lateral cephalogram and to establish a normal reference standard of Sella Turcica. Establishing a normative reference standards of Sella Turcica would assist in more objective evaluation and detection of pathological conditions.

Inclusion Criteria And Exclusion Criteria

Healthy patients in the age group 21-60 years without any history of systemic diseases and patients advised for lateral cephalometric radiographs for orthodontic treatment were included. Only radiographs of good quality, depicting a reference ruler on cephalostat for exact measurement of the magnification factors, were included in this study. Individuals with congenital defects in orofacial region like clefts and malformations and history of Craniofacial fractures were excluded from the study. Patients suffering from disorders of bone, nutritional deficiencies and endocrinal disturbances were also excluded from the study

MATERIAL AND METHODS

The present study is a retrospective study. The study sample included 40 lateral cephalograms of patient age between 21-60 years. The Digital cephalometric radiographs were collected from the oral medicine and radiology department, Madha dental college and hospital, kundrathur. The Institutional Ethical Committee approval was obtained. The Digital lateral cephalometric radiographs were taken during taken between January 2016 and March 2022. The Digital lateral cephalometric radiographs were taken by PLANMECA PROMAX machine with a tube voltage of 68 kvp tube current of 5 mAs and exposure time 0.8 sec.

The equal number of lateral cephalograms were grouped Into four groups based on age of the participant ;group I-age group 21-30 years, group II-31-40II-31-40 years, group III -age group 41-50 years, group IV – age group 51-60 years. The linear measurements of Sella Turcica such as length, depth and anteroposterior diameter have been measured using Digimizer software. The length is measured as linear distance from the superior most point on the Sella Turcica to the tip of the Dorsum Sella. The depth was measured as the line perpendicular from the line joining Tuberculum Sellae and Dorsum Sellae to the inferior most point on the floor. The anteroposterior diameter of Sella Turcica is measured from the superior most point on Tuberculum Sellae to the furthest point on the posterior inferior aspect on hypophyseal fossa (fig. 1).

Shape and morphological appearance of Sella Turcica was assessed based on Axelsson et al (2004a). According to Axelsson et al, in addition to the normal morphology, five morphological aberrations of Sella Turcica were commonly seen, which are oblique anterior wall, bridging of Sella Turcica, double contour of the floor, irregular surface (notch like depression) in the posterior aspect of the dorsum Sella, and pyramid shape of dorsum sellae.

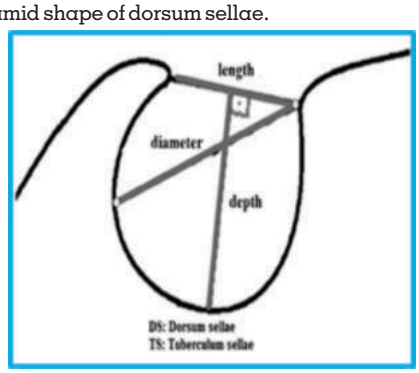


Fig. 1: Linear measurements on Sella Turcica

Statistical Analysis

Data were entered in Microsoft Excel spreadsheet and analysed using SPSS software (IBM SPSS Statistics, Version 20.0, Armonk, NY: IBM Corp.). Descriptive statistics were used for data summarization and presentation. Shapirowilks test was used to determine the normality of the data distribution. Data was normally distributed. Independent t-test and one-way ANOVA were used to compare the mean difference. The level of statistical significance was set at a value of $P < 0.05$.

RESULTS

In the total sample of 40 lateral cephalometric radiographs, 57.% (N=23) were females and 42.5% (N=17) were males (Table -1). The most commonly found morphology was Normal (N=15, 37.5%), followed by anterior oblique wall (N=6, 15%), irregular (N=6, 15%), bridging (N=5, 12.5%), pyramidal (N=5, 12.5%), and double contour (N=3, 7.5%). (Table -2)

On a gender wise comparison, the mean length, depth and anteroposterior width in males were 8.34 mm, 5.45 mm, and 8.70 mm respectively and in females were 7.33 mm, 5.99 mm, and 8.70 mm respectively. The length of Sella Turcica was larger in males whereas depth and anteroposterior width is larger in females. Independent t test was performed and a statistically significant difference was found in length (p=0.04). (Table 3)

The mean length (mm) of the Sella Turcica was 7.13, 8.31, 7.43, and 8.19 and mean depth (mm) was 5.48, 5.72, 5.95, and 5.91, for 21-30 years, 31-40 years, 41-50 years, and 51-60 years respectively. The anteroposterior width (mm) of the Sella Turcica was 8.37, 8.33, 9.33, and 8.86 for 21-30 years, 31-40 years, 41-50 years, and 51-60 years respectively. The mean depth and anteroposterior width is found to increase with age but not statistically significant. (Table-4)

On comparing the linear measurements of Sella Turcica with its morphology, the mean length was largest in the anterior oblique wall (9.19), least in normal (7.12) and found to be statistically significant. The mean depth was largest in anterior oblique (7.00) and least in pyramid al shaped Sella Turcica (4.92). The mean anteroposterior width was largest in the anterior oblique wall (10.43) and least in the normal shaped Sella Turcica (8.14). (Table-5)

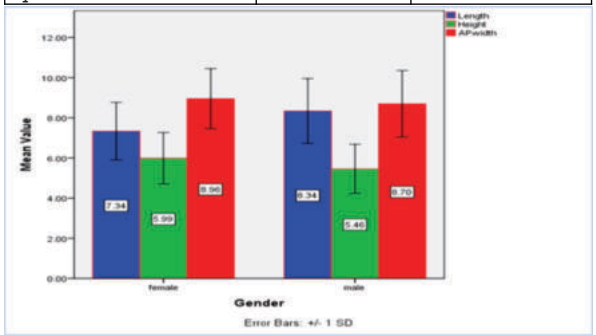
A statistically significant result was obtained in a one-way ANOVA test on comparing the length of Sella with its morphology. Hence multiple comparison using Post Hoc Tukey's were performed and a statistically significant result obtained. (Table-6)

Table-1; Gender Distribution Among Study Sample

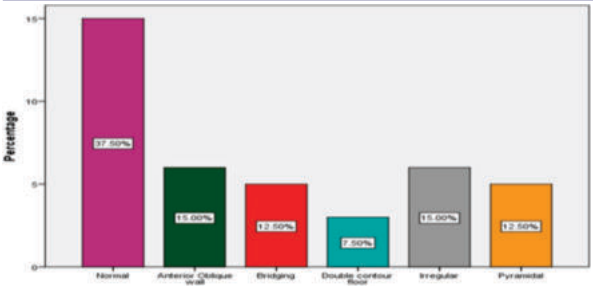
Categories	Frequency	Percentage (%)
females	23	57.5
Male	17	42.5

Table-2; Frequency Of Sella Turcica Among Study Sample

Categories	Frequency	Percentage (%)
Normal	15	37.5
Anterior Oblique wall	6	15.0
Bridging	5	12.5
Double contour floor	3	7.5
Irregular	6	15.0
Pyramidal	5	12.5



Graph-1; Mean Distribution Of Study Parameters According To Gender



Graph-2; Percentage Distribution Of Morphological Variation Among Study Participants

Table-3; Comparison Of Mean Length, Height And AP Width Of Sella Turcica Based On Gender

Variables	Gender	N	Mean	Std. Deviation	Independent "t" test	P value
Length	Female	23	7.33	1.43	2.07	0.04*
	Male	17	8.34	1.61		
Height	Female	23	5.99	1.27	1.32	0.19
	Male	17	5.45	1.21		
AP width	Female	23	8.95	1.49	0.51	0.611
	Male	17	8.70	1.65		

Table-4; Comparison Of Mean Length, Height And AP Width Of Sella Turcica Based On Age

Variables	Age group	N	Mean	SD	One way ANOVA value	P value
Length	21-30years	10	7.13	1.87	1.37	0.26
	31-40 years	10	8.31	1.53		
	41-50 years	10	7.43	1.19		
	51-60 years	10	8.19	1.53		
Height	21-30years	10	5.48	0.85	0.27	0.84
	31-40 years	10	5.72	1.21		
	41-50 years	10	5.95	1.32		
	51-60 years	10	5.91	1.68		
A P width	21-30years	10	8.37	1.77	0.62	0.60
	31-40 years	10	8.83	1.11		
	41-50 years	10	9.33	1.41		
	51-60 years	10	8.86	1.87		

Table-5; Comparison Of Mean Length, Height And AP Width Of Sella Turcica Based On Morphology

Variables	Morphology	N	Mean	SD	One way ANOVA value	P value
Length	Normal	15	7.12	1.01	5.66	0.001**
	Anterior Oblique wall	6	9.16	1.33		
	Bridging	5	6.32	1.29		
	Double contour floor	3	7.96	1.76		
	Irregular	6	7.60	1.33		
	Pyramidal	5	9.52	1.39		
Height	Normal	15	5.86	0.90	2.05	0.09
	Anterior Oblique wall	6	7.00	1.65		
	Bridging	5	5.38	1.45		
	Double contour floor	3	5.53	0.51		
	Irregular	6	5.41	1.21		
	Pyramidal	5	4.92	1.27		
A P width	Normal	15	8.14	1.20	2.26	0.07
	Anterior Oblique wall	6	10.43	1.60		
	Bridging	5	8.74	1.33		
	Double contour floor	3	8.70	0.36		
	Irregular	6	9.18	2.15		
	Pyramidal	5	8.86	1.28		

Table-6; Post Hoc Tukey For Length Of Sella Turcica Based On Morphology

(I) morphology	(J) morphology	Mean Difference (I-J)	Sig.
Normal	Anterior Oblique wall	-2.04*	0.02
	Bridging	0.80	0.80
	Double contour floor	-0.84	0.89
	Irregular	-0.47	0.96
	Pyramidal	-2.39*	0.00
Anterior Oblique wall	Normal	2.04*	0.02
	Bridging	2.84*	0.00
	Double contour floor	1.20	0.74
	Irregular	1.56	0.27
	Pyramidal	-0.35	0.99
Bridging	Normal	-0.80	0.80
	Anterior Oblique wall	-2.84*	0.00
	Double contour floor	-1.64	0.47
	Irregular	-1.28	0.54
	Pyramidal	-3.20*	0.00
Double contour floor	Normal	0.84	0.89
	Anterior Oblique wall	-1.20	0.74
	Bridging	1.64	0.47
	Irregular	0.36	0.99
	Pyramidal	-1.55	0.53
Irregular	Normal	0.47	0.96
	Anterior Oblique wall	-1.56	0.27
	Bridging	1.28	0.54
	Double contour floor	-0.36	0.99
	Pyramidal	-1.92	0.14
Pyramidal	Normal	2.39*	0.00
	Anterior Oblique wall	0.35	0.99
	Bridging	3.20*	0.00
	Double contour floor	1.55	0.53
	Irregular	1.92	0.14

DISCUSSION

The lateral cephalometric radiograph unveils a number of craniofacial and oral structures. Cephalometric radiography plays a major role in diagnosis, treatment planning, evaluating the growth changes, and predicting the prognosis. Sella Turcica is readily recognized and well appreciated on lateral cephalometric radiographs and is routinely traced for cephalometric analysis.

Beyond its anatomical importance, the size and morphology of Sella Turcica are found to be highly variable and are different from person to person. Pathological conditions that occur in the pituitary gland can cause morphological changes and the size of Sella Turcica. The common morphology of Sella Turcica is studied beforehand for assessment of any unusual appearance present in the sellar region

Background literature reveals that many similar studies were performed in a younger age group (<20 years), whereas in the present study, this age group was excluded and wider age group of 20-60 years were included. The reason behind this is that in population less than 20 years are in the growth phase and a wider age group is included to evaluate the age-related changes of Sella Turcica.

The prevalence of normal morphology, anterior oblique wall, and pyramidal shape of Sella Turcica is lower in our study whereas the prevalence of irregular shaped, Sella Turcica bridging and double contour floor is higher in our study compared to Tejavathi Nagaraj et al study [4].

On comparing the present study with a study by Chaitanya et al [5], the prevalence of the normal morphology, irregular shaped sellae, and Sella Turcica bridging are higher but the prevalence of anterior oblique wall, double contour floor, and pyramidal shaped Sella is lesser.

Similar to the present study, In Chaitanya, et al study [5], the length of Sella Turcica is larger in males whereas depth and anteroposterior width are larger in females. In contrast, in Otuyemi et al Study, the length and anteroposterior width were larger in males whereas the depth of Sella Turcica was larger in females

Areej A. Najim et al conducted a similar study in Iraqi population [6]. The mean linear dimensions (length, depth, and anteroposterior width) of Sella Turcica were larger compared to the present study. However, In a study conducted by Otuyemi et al in the Nigerian population .. The mean linear dimensions (length, depth, and anteroposterior width) of Sella Turcica were smaller compared to the present study. This discrepancy may be attributed to geographical and ethnic variations.[7]

In a study by Najim et al [6] and, Arshiya Ara et al [8], there is a gradual increase in the size of Sella Turcica as age advances, which is similar to the present study. Konwar, et al noted that A direct correlation existed between the patient's age and the anteroposterior width of Sella Turcica.

CONCLUSIONS

The results can be used as a reference in future studies with a larger study population. Changes in shape and size of the Sella Turcica are frequently related to pathology and syndromes associated with the pituitary gland. Dentists take lateral cephalograms routinely as part of their treatment planning. Hence, they should be familiar with the normal radiographic anatomy and morphologic variability of this area, to recognize and investigate deviations. An abnormal Sella Turcica may be an incidental finding on a skull film. Abnormal findings in the morphology should be subjected to advanced imaging modalities such as CT and MRI for confirming the pathology. On average, approximately 25% of the patients have pituitary adenomas, which are often found incidentally.

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