Original Article

Study of patterns of sella turcica with different malocclusions

ABSTRACT

Background: In the field of orthodontics and dentofacial orthopedics, for treatment of malocclusion, diagnosis of facial skeletal type is one of the important aspects. Sometimes, cephalograms are not enough to determine the facial skeletal pattern. Hence, the relationship between sella turcica and other facial skeletal patterns can guide us to determine the proper facial skeletal type and can also help in treatment planning.

Aims: The aim of the study was to investigate the normalcy of the dimensions of sella turcica and comparison of the relationship of sella turcica with different skeletal malocclusions.

Materials and Methods: A total of 90 pretreatment digital lateral cephalograms were selected according to the criteria and grouped into 3 groups: Group 1: Class I (n = 30), Group 2: Class II (n = 30), and Group 3: Class III (n = 30). Lateral cephalograms were traced and studied on the basis of sella turcica. The following linear measurements were recorded: length, depth, and diameter of the sella.

Statistical Analysis Used: Data were subjected to descriptive analysis for mean and standard deviation of all variables and ranges. ANOVA and a *post hoc* test (Bonferroni and Sidak) were used for multiple comparisons. P <0.05 was considered as the level for statistically significant data.

Results: The linear measurements of length and diameter showed statistically significant differences in Class I, Class II, and Class III (P = 0.005). However, depth showed no statistically significant difference in the groups.

Conclusions: The importance of sella turcica is established and normalcy is set by statistical analysis, and the standard values are given for the dimensions of the sella turcica. This can be used for further analysis and reference standards for the Indian population. The length and diameter were statistically significant with different groups. The largest value was given in Class III.

Keywords: ANOVA test, lateral cephalograms, malocclusions, sella turcica, sella turcica dimensions

INTRODUCTION

The sella turcica is a saddle-shaped depression in the body of the sphenoid bone of human skull and of the skulls of other hominids including chimpanzees, orangutans, and gorillas. The pituitary gland of hypophysis is located within the most inferior aspect of the sella turcica, the hypophyseal fossa.

It serves as a cephalometric landmark.[1] The sella turcica is a structure which can be readily seen on lateral cephalometric radiographs, and sella point is routinely traced for various cephalometric analyses.[2-4] The morphology is very important for the cephalometric position of the reference point sella, not only for evaluating craniofacial morphology but also when growth changes and orthodontic treatment results are to be evaluated. This makes it a good source of additional diagnostic information related to pathology of the pituitary gland, or to various syndromes that affect the craniofacial region.[5-10]

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Clinicians should be familiar with the normal radiographic anatomy and morphologic variability of this area, to recognize and investigate deviations that may reflect pathological situations, even before these become clinically apparent. Abnormal sella turcica causes various diseases such as intrasellar pituitary primary tumors, hypopituitarism, or syndromes like Williams or Sheehan's syndrome.[5] Furthermore, keeping in mind the cephalocaudal gradient of growth, the size of the sella may be a key diagnosing factor of Class III and Class II patients, and early treatment can be planned. As the maturation of the sella will take place before the mandible and hence can help in diagnosis of a large or short jaw.

Therefore, the purpose of the study was to investigate the normalcy of the dimensions of sella turcica and comparison of the relationship of sella turcica with different skeletal malocclusion. In orthodontics, sella point which is located at the center of sella turcica is one of the most commonly used landmarks in cephalometrics.[6-9] Such landmarks located within the craniofacial region are used to measure the positions of maxilla and mandible in relation to the cranium and to themselves. The benefits gained from studying these structures range from assisting the orthodontist during diagnosis, as a tool to study growth in an individual through superimposition of structures on a longitudinal basis, and during evaluation of orthodontic treatment results. Since sella area is an important region, and morphology may vary from individual to individual, establishing normal standards will aid in the process of eliminating any abnormality in the size or shape of sella turcica.[10]

MATERIALS AND METHODS

Ninety pretreatment lateral cephalograms were selected on the basis mentioned below. The ethical approval was obtained from the institutional ethical committee. Being a retrospective study, the patients were informed that their lateral cephalograms will be used for further studies, and consent was obtained during that time. Criteria for selection of cephalograms were as follows:

1. Individual with no previous orthodontic treatment
2. Individual should be healthy with no systemic diseases
3. Individual should be above 18 years
4. All Class I malocclusion patients had an A point, nasion, B point (ANB) value 1°–3°
5. All Class II malocclusion patients had an of ANB value >4°
6. All Class III malocclusion patients had an ANB value <1°.

Cephalograms were divided into 3 groups: Class I malocclusion (n = 30), Class II malocclusion (n = 30), and Class III malocclusion (n = 30). They were traced by single researcher using 0.5 mm lead pencil and an orthodontic paper. Beside routine anatomical designs, the cephalometric points traced are given in Table 1, and linear measurements taken are in Table 2 (refer to Figure 1).

Statistical methods

The data were statistically analyzed with SPSS 20 Software (IBM, Chicago, Illinois, USA). Data were subjected to descriptive analysis for mean and standard deviation (SD) of all variables and ranges. ANOVA and a *post hoc* test (Bonferroni and Sidak) were used for multiple comparisons [Tables 3 and 4]. P <0.05 was considered as the level for statistically significant data.

RESULTS

The linear measurements with the arithmetic mean and SDs are tabulated in Table 3. This sets the normalcy of the size of the sella turcica and can be used for further analysis and as a reference for further studies in the Indian population. The linear measurements of the length (a) was statistically significant in different groups: Class I, Class II, and Class III (P = 0.043). The effective length of the mandible was statistically significant and showed the length of the mandible in different classes (P = 0.002). This shows the variation in length in different classes.

Table 1: Cephalometric points

	Measurements
Point A	The deepest midline point on the premaxilla between the anterior nasal spine and prosthion
Point B	The most posterior point in the concavity between the infradentale and pogonion
N (nasion)	The anterior limit of the frontonasal suture
Co	The most posterior and superior point on the condyle of the mandible
Gn (Gnathion)	The most anterior and inferior point on the symphysis of the mandible
Tuberculum sella (T)	The most anterior point on the body of the atlas vertebrae seen on the lateral cephalogram
Dorsum sella (D)	The tip of the posterior nasal spine seen on the lateral cephalogram or spina nasalis posterior
Sella turcica floor	The base of the sella turcica was considered as the floor
Anterior and posterior clinoid process	Also known as the Tuberculum sellae and the dorsum sellae, they are the bony elevations of the sella turcica anteriorly and posteriorly, respectively

Table 2: Linear measurements

	Measurements
Co-Gn	The effective length of the mandible
Length of sella turcica (a)	The linear distance from the tuberculum sella to the tip of the dorsum sellae
Depth of sella turcica (b)	Was measured perpendicular from the line above to the deepest point on the floor
Anteroposterior diameter of sella turcica (d)	A line drawn from the tuberculum sella to the furthest point on the posterior inner wall of the fossa

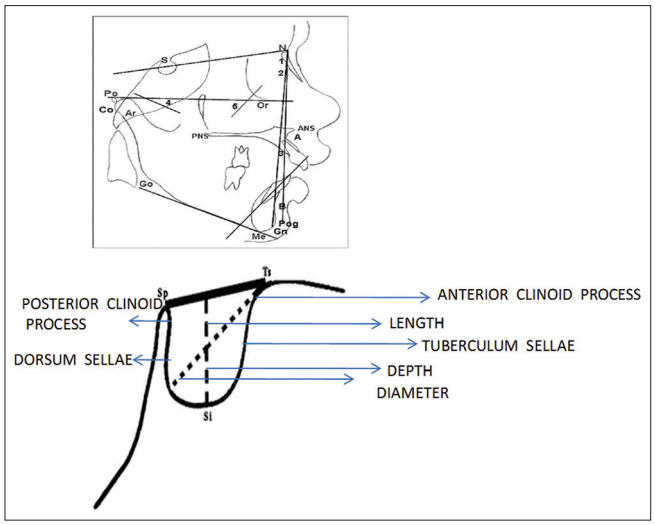

Figure 1: Cephalometric points

Due to inconsistency of the reader or the small number of data, no statistical difference was found between Class I and Class II. Furthermore, the depth of the sella was not statistically significant in Class I, Class II, and Class III individuals and showed no correlation between the length of the mandible and the depth of the sella turcica ($P \geq 0.05$). This further also states that the size of the sella turcica is largest in Class III individuals as compared to Class I and Class II individuals.

DISCUSSION

From this study, it can be inferred that the length of sella turcica is directly correlated to the effective length of the mandible, i.e., the skeletal type. In some cases, the depth of sella may be correlated with the facial pattern. As we have seen that size of sella turcica is greater in Class III malocclusion, it can also mean that the size of pituitary gland may also be greater, which can also lead to considerably more release of growth hormone that can increase the growth of mandible leading it to Class III malocclusion.[11-17] The measurement and morphology of sella turcica are valuable in the assessment of pathology in the pituitary gland. Studies of sella turcica size on radiographs have been based on linear or various methods of area and volume measurements.[18,19] Based on anteroposterior relation of maxilla with mandible, facial skeletal patterns are classified as Class I, Class II, and Class III. The orthodontic treatment for all three facial skeletal patterns is different. Before commencement of treatment, it is necessary to determine the relation between both the jaws. Sometimes, measurements done during lateral cephalometric analysis may provide a borderline finding which makes it difficult to differentiate between skeletal facial patterns.[20,21] Hence, to determine a proper treatment plan, the shape and size of sella turcica can help in determining the facial skeletal type.[22,23] In the present study, manual tracing was used for calculation of the length, depth, and diameter of the sella turcica. Although in some studies, the digital method was used to measure these factors, the manual technique has accuracy similar to that of digital technique in this regard.[4] Thus, considering its affordability, the manual technique was used. It seems that further investigations in several centers with larger sample sizes can increase the accuracy of the obtained data and standards.

Table 3: Comparison of size of sella turcica in different skeletal patterns using ANOVA test

Variable	Group	Mean (SD)	ANOVA *F*-test	*P*	Significance
Length of sella turcica	Class I	7.73 (1.7)	3.268	0.043	Significant
	Class II	8.06 (1.85)			
	Class III	8.9 (1.90)			
Depth of sella turcica	Class I	7.53 (1.35)	0.070	0.933	Nonsignificant
	Class II	7.63 (1.40)			
	Class III	7.50 (1.54)			
Diameter of sella turcica	Class I	10.23 (1.47)	1.453	0.240	Nonsignificant
	Class II	10.46 (1.59)			
	Class III	10.86 (1.27)			
Effective length of the mandible	Class I	1.05 (7.28)	6.924	0.002	Significant
	Class II	1.13 (9.45)			
	Class III	1.06 (8.42)			

SD: Standard deviation

Table 4: Bonferroni and Sidak methods used for *post hoc* analysis

Dependent variable	*Post hoc* test	(I) Type	(J) Type	*P*
Length of sella turcica	Bonferroni	Class I	Class II	0.56
			Class III	0.045*
		Class II	Class III	0.239
	Sidak	Class I	Class II	0.860
			Class III	0.044*
		Class II	Class III	0.221
Depth of sella turcica	Bonferroni	Class I	Class II	1.00
			Class III	1.00
		Class II	Class III	1.00
	Sidak	Class I	Class II	0.991
			Class III	1.00
		Class II	Class III	0.978
Diameter of sella turcica	Bonferroni	Class I	Class II	1.00
			Class III	0.287
		Class II	Class III	0.870
	Sidak	Class I	Class II	0.90
			Class III	0.260
		Class II	Class III	0.642
Effective length of sella turcica	Bonferroni	Class I	Class II	0.002*
			Class III	1.0000
		Class II	Class III	0.014*
	Sidak	Class I	Class II	0.002*
			Class III	0.916
		Class II	Class III	0.014*

*Significance

CONCLUSIONS

- In skeletal Class III or prognathic mandible, the anteroposterior dimensions of the sella turcica, that is, the length and the diameter are the largest as compared to Class I and Class II
- Depth of the sella turcica and the effective length of the mandible do not correlate with the three skeletal types.

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Conflicts of interest

There are no conflicts of interest.

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