

**DIMENSIONAL CO-RELATIONSHIPS OF SELLA TURCICA WITH DIFFERENT SKELETAL MALOCCLUSIONS AND GROWTH PATTERNS – A RETROSPECTIVE STUDY****Dr. Soumya Gupta<sup>\*a</sup>, Dr. Gangesh B Singh<sup>b</sup>, Dr. Fiza Khan<sup>c</sup>, Dr. Rakshit Sthapak<sup>a</sup>, Dr. Meenakshi Mukherjee<sup>d</sup>, Dr. Anjali Rajan<sup>e</sup>**<sup>a</sup>Reader, Department of Orthodontics and Dentofacial Orthopedics, New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh- 495001.<sup>b</sup>Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, Government Dental College, Raipur, Chhattisgarh- 492013.<sup>c</sup>Reader, Department of Oral Medicine and Radiology, New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh- 495001.<sup>d</sup>Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh- 495001.<sup>e</sup>Postgraduate student, Department of Orthodontics and Dentofacial Orthopedics, Meenakshi Ammal Dental College, Chennai.**\*Corresponding Author: Dr. Soumya Gupta**

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Article Received on 30/03/2022

Article Revised on 20/04/2022

Article Accepted on 11/05/2022

**ABSTRACT**

**Background:** In the branch of orthodontics, to treat the malocclusion diagnosis of the facial skeletal aspects is an important aspect. Cephalometric is one of the means used in diagnosis and treatment planning. The Sella Point (midpoint of *sellae turcica*) constitutes an important reference point. So, the purpose of this study was to measure the dimensions of sella turcica and its relation with different skeletal patterns, growth patterns and, effective mandibular length. **Material and Methods:** A cross-sectional retrospective study with 180 pre-treatment lateral cephalographs with the age ranges from 15-26 years consisted of 91 females and 89 males. The length, depth and, diameter of sellae turcica were measured cephalometrically and assessed with different skeletal patterns. **Results:** There was no significant difference observed between the sella dimension with various skeletal patterns and growth patterns. However, there was a weakly positive correlation between the effective mandibular length and the parameters of sellae turcica. **Conclusion:** The largest diameter and length were seen in the skeletal class III pattern suggestive of greater space for the accommodation of larger size pituitary gland so more release of growth hormone leading to late mandibular growth in skeletal class III individuals.

**KEYWORDS:** Sella turcica, skeletal patterns, lateral cephalographs, ANOVA test.**INTRODUCTION**

For proper treatment planning, one of the routinely used diagnostic methods is lateral cephalogram. The identification of various landmarks during the tracing of the radiographs is essential. These points help in analyzing the relative positions of the maxilla and the mandible with themselves and to the cranium. The commonly used landmark in cephalometry is *Sella Turcica*.<sup>[1]</sup>

It's a saddle-shaped bony depression seen in the lateral cephalographs situated in the intracranial surface of the sphenoid bone, containing the pituitary gland. The pituitary fossa is made by two anterior and posterior clinoid processes. The anterior wall is made by tuberculum sellae whereas the posterior is formed by

dorsum sellae. *Sella point* is the geometric center of the Sella Turcica.<sup>[2]</sup>

The orthodontic literature has illustrated the changes in Sella Turcica shape during growth (Björk, 1955; Melsen, 1974; Björk and Skieller, 1983).<sup>[3,4]</sup> Melsen (1974) found that apposition of bone on the anterior part of the interior surface of the Sella Turcica ceased at an early age, whereas resorption on the distal surface of the Sella floor and the posterior wall continued for a longer period.<sup>[5]</sup> Apposition of bone was observed at the Tuberculum Sella and resorption at the posterior boundary of the Sella Turcica up to the 16–18 years of age (Björk, 1955; Melsen, 1974; Björk and Skieller, 1983).

Most of the changes in craniofacial morphology occur at the 6-18 years of age in males and 6-15 years in females.<sup>[6]</sup> Surface area of the sella turcica varies from 18- 115 mm<sup>2</sup> in females and 22 – 122 mm<sup>2</sup> in males.<sup>[7]</sup> A difference in morphology is observed from one individual to another. A deviation in size and shape may indicate pathological conditions such as hyperprolactinemia, pituitary adenoma, Williams, or Shehan's syndrome associated with the gland.<sup>[8]</sup> The size of the Sella Turcica is variable with normal dimensions ranging from an anteroposterior diameter of 5-16 mm and depth of 4-12 mm.<sup>[9]</sup>

Furthermore, keeping in mind the cephalocaudal gradient of growth, the size of the sella may be a key diagnosing factor for skeletal Class I, Class II, and Class III patients, and early treatment can be planned. The morphology of the Sella Turcica is of importance for the cephalometric position of the point Sella, not only when evaluating growth changes, but also orthodontic treatment results are to be evaluated.<sup>[10]</sup> As the maturation of the Sella will take place before the mandible and hence can help in the diagnosis of the length i.e. large or short jaw and also the growth pattern of an individual.

So, the purpose of the study is to investigate the dimension of Sella Turcica and comparison of relationships with different skeletal malocclusion and genders and also to determine that if a difference exists due to gender or age or in subjects with different skeletal and growth patterns.

## MATERIALS AND METHOD

A cross-sectional retrospective study design was selected. The data were collected from the archives of the patient visiting the dental institute. The ethical approval was obtained from the institutional ethical committee. As a retrospective study, the patients were informed that their lateral cephalographs will be used for further studies, and consent was obtained. To maintain the standardization lateral cephalogram was recorded by

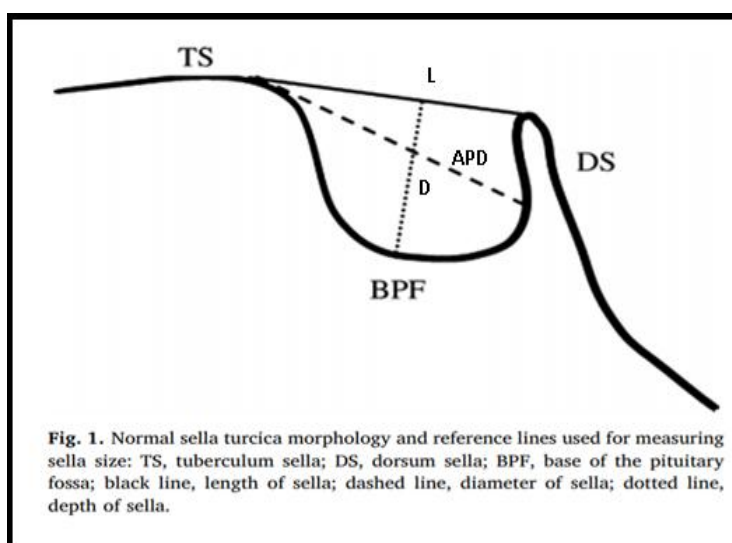
the same radiographic technician with the same equipment (Sirona Orthophos XGS, Germany) in standardized conditions the natural head posture (NHP) using cephalostat. A tube voltage of 73 kV, a tube current of 15 mA, and an exposure time of approximately 9.4 sec. was used for recording lateral cephalogram.

**Sample Size estimation:** The power of the study is 90%. The study sample consisted of 180 pre-treatment lateral cephalographs at a confidence interval of 95%. Cephalographs were traced at a 0.003-inch acetate sheet by a single examiner (SG). (Figure 2)

**Inclusion and Exclusion Criteria:** Lateral cephalographs tracings with good visibility of all cephalometric structures were included. Age groups taken were 15- 26 years consisting of 91 females and 89 males with different skeletal patterns. Patient with no history of previous orthodontic treatment. The skeletal classification was done based on ANB angle (2° - 4°) as Class I; less than 2° as Class III and more than 4° was skeletal Class II according to Steiner Analysis.<sup>[11]</sup> The growth pattern of the individuals was also considered using subjects SN-MP > 32° as a vertical grower and SN-MP < 32° as the horizontal growth pattern. Patients with radiographic evidence of craniofacial abnormalities and maxillofacial surgery trauma were excluded.

**To measure the size of Sella Turcica** – It was measured in the mid-sagittal plane which was measured according to the methods given by Silverman and Kisling.<sup>[12,13]</sup>

- **Length (L)** – the linear distance from *tuberculum sella* (TS) to the tip of *dorsum sella* (DS).
- **Depth (D)** - a perpendicular line drawn above to the deepest point on the floor of the pituitary fossa.
- **Anteroposterior diameter (APD)** - was measured from the *tuberculum sella* (TS) to the point which is farther located on the posterior inner wall of the fossa. (Figure 1)



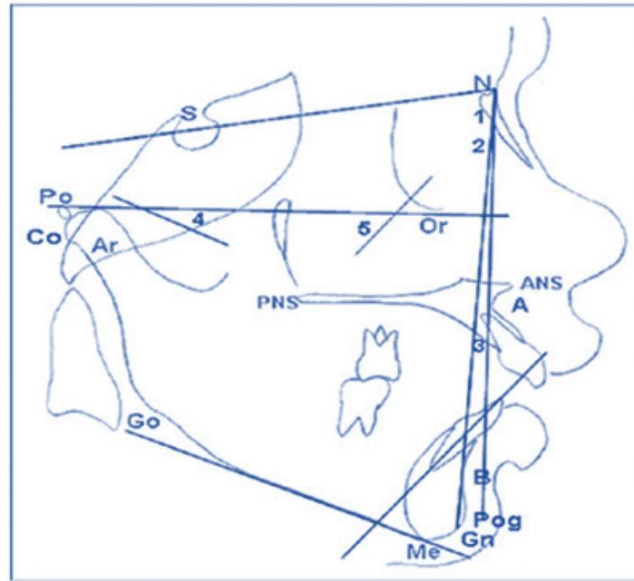


Figure 2: Cephalometric tracing showing various Angular and linear measurements.

**STATISTICAL ANALYSIS**

The data were tabulated in Microsoft Excel software and analyzed with SPSS V.20 software.

To describe the data descriptive statistics were used for categorical variables and the mean and Standard deviation (SD) were used for continuous variables. An unpaired independent t-test was done for the comparison between the genders. One-way ANOVA was done for the comparison between the sagittal skeletal patterns and the growth patterns. Pearson correlation analysis was performed to assess the association between the dimensions of sella turcica with different cephalometric variables as growth patterns and the length of the mandible (Cd-Go).

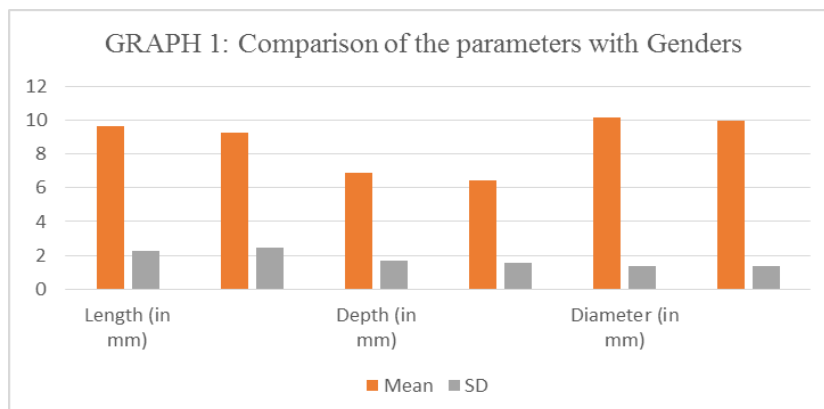
**RESULT**

The parameters were considered to assess the comparison between the Length, Depth, and Diameter of Sella turcica with the skeletal malocclusion (ANB) and growth pattern (SN- GoGn) as well as the length of the mandible (Cd- Go). The p-value was set at  $\leq 0.05$ .

In comparison between the genders and the sella parameters (length, diameter, and depth) there was no statistically significant difference, as shown in Table 1 and Graph 1. However, the length and diameter were more in males ( 9.66 and 10.18) than in females (9.29 and 9.97) respectively, and in contrast to the depth (6.92 and 6.46) in both the genders.

Table 1. Comparison of the parameters between the genders using Independent t-test.

Parameters	Gender	N	Mean	SD	Mean difference(95% CI)	T	p value
Length (in mm)	Male	90	9.66	2.26	0.36 (-0.33, 1.06)	1.034	0.302
	Female	90	9.29	2.48			
Depth (in mm)	Male	90	6.92	1.66	0.46 (-0.01, 0.94)	1.925	0.056
	Female	90	6.46	1.58			
Diameter (in mm)	Male	90	10.18	1.37	0.20 (-0.20, 0.61)	0.997	0.320
	Female	90	9.97	1.38			



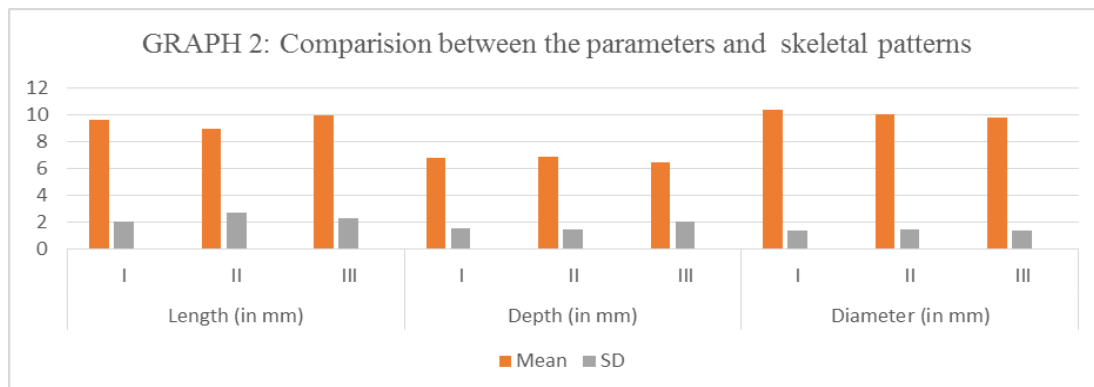
One-way ANOVA was done for the comparison between the sagittal skeletal patterns as (Class I, Class II, and Class III) and the linear dimensions of sella turcica in (Length, Depth, and Diameter). The linear measurements of the sella turcica were not statistically significant with the different skeletal patterns i.e. ( $P = 0.075, 0.356, 0.069$ ). The largest measurement was that of diameter in skeletal Class I pattern ( $10.37 \pm 1.32$ ) followed by Class II than Class III pattern. The smallest measurement was of depth in skeletal class III pattern ( $6.42 \pm 1.98$ ) followed by Class I than Class II pattern. The length was

largest in skeletal class III ( $9.92 \pm 2.23$ ) followed by Class I and Class II. In comparison with all the skeletal patterns to the dimensions sella turcica, the diameter is the largest than comes the length and, then the depth and there is no statistically significant difference between the skeletal pattern and the linear dimensions as shown in Table 2 and Graph 2. The effective length of the mandible (Cd-Go) was also not statistically significant and showed it with different skeletal patterns ( $P = 0.177$ ).

**Table 2: Comparison of the parameters between the skeletal pattern using One way ANOVA.**

Parameters	Class	N	Mean	SD	F	p-value
Length (in mm)	I	61	9.64	2.05	2.624	0.075
	II	67	8.97	2.69		
	III	52	9.92	2.23		
Depth (in mm)	I	61	6.74	1.48	1.039	0.356
	II	67	6.85	1.46		
	III	52	6.42	1.98		
Diameter (in mm)	I	61	10.37	1.32	2.716	0.069
	II	67	10.04	1.39		
	III	52	9.77	1.38		
Cd-Go	I	61	56.05	5.93	1.748	0.177
	II	67	55.94	4.69		
	III	52	57.04	6.64		

\*Statistically significant difference exists between the groups ( $p < 0.05$ )



In comparison between the growth patterns and the dimensions of the sella turcica one way, ANOVA was used. SN plane to mandibular plane was used to determine the growth pattern of the subjects with different skeletal patterns. The p-value was  $\leq 0.05$  which was considered statistically significant but no statistically significant difference was seen between the growth pattern with sella turcica dimensions as shown in Table

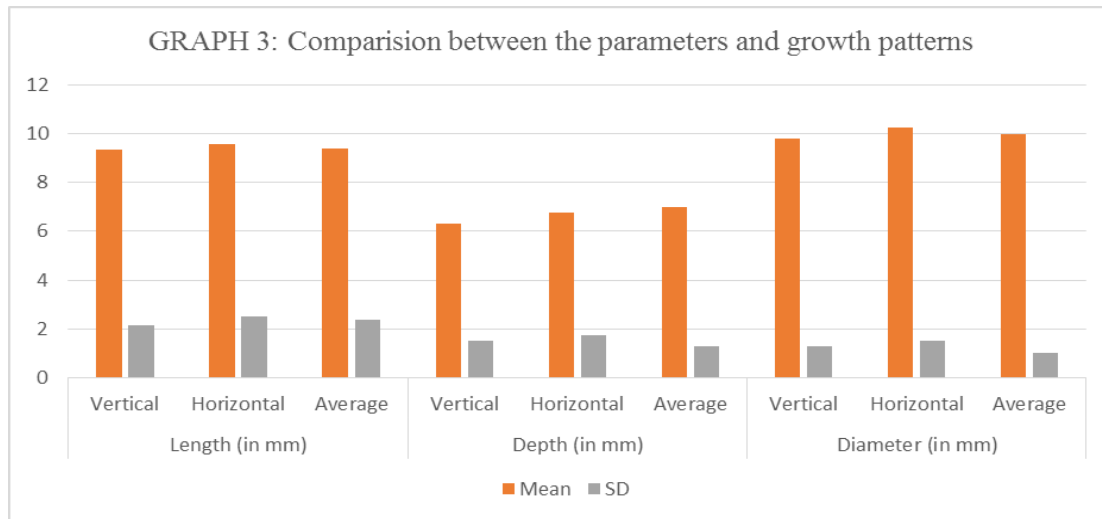
3. However, vertical growing subjects had the smallest of all sella turcica dimensions i.e. length ( $9.35 \pm 2.35$ ), depth ( $6.33 \pm 1.50$ ) and, diameter ( $9.81 \pm 1.30$ ). In horizontal growth pattern, the length ( $9.56 \pm 2.50$ ) and diameter ( $10.23 \pm 1.49$ ) is greater than the depth ( $6.78 \pm 1.76$ ) whereas in average growing patients the depth is maximum ( $7.00 \pm 1.27$ ) as shown in Graph 3.

**Table 3: Comparison of the parameters between the growth pattern using ANOVA.**

Parameters	Growth patterns	N	Mean	SD	F	p-value
Length (in mm)	Vertical	51	9.35	2.13	0.155	0.857
	Horizontal	102	9.56	2.50		
	Average	27	9.37	2.38		
Depth (in mm)	Vertical	51	6.33	1.50	1.879	0.156
	Horizontal	102	6.78	1.76		
	Average	27	7.00	1.27		

Diameter (in mm)	Vertical	51	9.81	1.30	1.564	0.212
	Horizontal	102	10.23	1.49		
	Average	27	10.00	1.00		

\*Statistically significant difference exists between the groups ( $p < 0.05$ )



Using the Pearson's correlation test it signifies there was a weakly positive correlation between dimensions of Sella Turcica and length of the mandible with the vertical

and horizontal growth pattern and weakly negative correlation with the average growing individuals Table 4.

**Table 4: Correlation between the dimensions of sella turcica with the length of mandible and growth patterns.**

Growth patterns	Correlation between	Pearson's correlation coefficient (r)	Interpretation
Vertical	Length and Cd-Go	0.029	Weakly positive correlation
	Depth and Cd-Go	0.116	Weakly positive correlation
	Diameter and Cd-Go	0.100	Weakly positive correlation
Horizontal	Length and Cd-Go	0.099	Weakly positive correlation
	Depth and Cd-Go	0.257	Weakly positive correlation
	Diameter and Cd-Go	0.235	Weakly positive correlation
Average	Length and Cd-Go	-0.023	Weakly negative correlation
	Depth and Cd-Go	-0.007	Weakly negative correlation
	Diameter and Cd-Go	-0.056	Weakly negative correlation

## DISCUSSION

Treatment planning and protocol for all the facial skeletal pattern is different. So, before the commencement of the treatment, it was important to determine the relationship between the cranial base to both the jaws.<sup>[14]</sup> In cephalometric analysis, the measurement may sometimes provide borderline values which makes it difficult to differentiate between the skeletal facial patterns.<sup>[15,16]</sup> Hence, to determine the proper treatment plan, the size of sella turcica could help in determining the skeletal pattern.<sup>[17,18]</sup>

In this study, the male group had increase measurements than females in respect to length and diameter, but the depth was more in females than males. Similar findings had been reported by Hass et al and Hasan et al.<sup>[19,28]</sup> However, the difference between them was non-significant; which is similar to the study reported by Alkofide, Axelsson et al, Sinha et al.<sup>[2,10,20]</sup>

Sella Turcica's linear dimensions were compared with the skeletal and growth patterns of the individuals. The largest length with skeletal class III, depth in class II and, diameter in class I. However, there was no significant correlation between the mean to the different skeletal patterns which was similar to the study done by Shah et al, Yassir et al and Preston.<sup>[21,22,23]</sup> But, in the study that was done by Alkofide, Sinha et al showed a significant difference in the relation between skeletal types and Sella dimensions.<sup>[2,20]</sup> The size of sella turcica was greater in class III patterns, which means that the size of the pituitary gland may also be greater which may lead to greater release of growth hormone that increased the growth of mandible in skeletal class III malocclusion.<sup>[24,25,26]</sup>

In this study, the dimension of sella turcica was not significant with that of the growth pattern of the individuals. However, the dimensions were comparatively less in vertical growing individuals



whereas, the length and diameter were greatest in the horizontal growing subjects. Konwar *et al*<sup>27</sup> stated that there was a significant difference between the growth pattern and the dimensions of sellae turcica which was dissimilar to the current study.

There are a few limitations in this study, manual tracing was done to determine the measurements of the length, depth and, diameter of the *sellae*. Axelsson *et al* stated that the manual technique had similar accuracy to that of a digital method in this regard.<sup>[10]</sup> So, seeing the affordability the manual technique was used. However, further investigation using digital techniques to be used so to have more accuracy of data and standardization. Morphometry was considered in this study so further evaluation and its correlation with the growth pattern and mandibular length need to be done and advanced radiographic techniques and imaging such as 3D imaging techniques give a better and accurate extent and, hence play a key role in the diagnosis and treatment planning.<sup>[29,30,31,32]</sup>

The findings of the linear dimensions obtained from this study can be used to have an approximate idea of the size of the pituitary gland, which may help the orthodontist when faced with a dilemma of an abnormally large sella turcica on the lateral cephalograms, and this may help the clinician to have complete knowledge of the different shapes of the sella turcica.

## CONCLUSION

There were no significant differences in the size of the sellae turcica irrespective of the genders in this study. In skeletal Class III patterns, the anteroposterior dimension was largest compared to class II and I. The growth pattern of the individuals does not correlate with the dimensions of sella turcica. However, there was a weakly positive correlation between the effective mandibular length (Cd- Go) to the sella dimensions.

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