

Prevalence Of Sella Turcica Morphology In Hypodivergent And Hyperdivergent Facial Growth Patterns - A Cephalometric Study

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Abstract

Background: Sella turcica is the most commonly used landmarks in cephalometrics and is located at the centre of the cranium and is an important structure seen in the neurocranial and craniofacial region. The morphology of sella is important for the cephalometric position as a reference point when evaluating growth changes and progress in Orthodontic treatment . The aim of this study was to determine the correlation between the sellar characteristics and facial growth patterns.

Material and Methods: A total of 90 cephalograms of the subjects reporting for Orthodontic treatment were collected, the cephalograms were divided into two groups. Group I consisting of 45 cephalograms with hypodivergent growth pattern and Group II consisting of 45 cephalograms with hyperdivergent growth pattern. Growth pattern was classified according to the mandibular plane as SN-MP $>38^\circ$ for hyperdivergent growth pattern and SN-MP $<26^\circ$ for hypodivergent growth pattern. Each cephalogram was traced manually on acetate paper using a tracing pencil and under optimal lighting conditions by same operator. In both the groups, shape, length, depth, diameter of the sella were determined. The data was tabulated in excel sheets and sent for statistical analysis. Mean, standard deviation and error were calculated. Independent t-test was used to determine the correlation between the variables.

Results: The results revealed the length, depth, diameter of the sell was greater in the hyperdivergent growth pattern as compared to hypodivergent growth pattern. The length ($p=0.0255$) and diameter ($p=0.0009$) were statistically significant . Normal shape of sella was more prevalent in both group I &II (62.22% & 44.44%). Oblique morphologic shape was second most prevalent (33.33%) in hyperdivergent growth pattern

Conclusion: This study concluded that a correlation exists between the two facial growth patterns and sella length and diameter. Length, diameter and depth are increased in hyperdivergent growth pattern as compared to hypodivergent growth pattern. Oblique shape was second most common in hyperdivergent growth pattern. Such studies are helpful in knowing the normal morphology of sella in various growth patterns which can help in cephalometric tracing, growth superimpositions as well as in growth forecasting and treatment planning in growing children.

Keywords: Sella Turcica, hypodivergent growth pattern, hyperdivergent growth pattern.

INTRODUCTION

When analysing the neurocranial and craniofacial complex on lateral cephalograms, the sella turcica is a crucial anatomical landmark in Orthodontics. The sella point, which is at the middle of the sella turcica, is one of the most often utilised landmarks in orthodontics. These landmarks in the craniofacial area are employed to estimate the distances between the maxilla, mandible and the cranium. Studying these structures has numerous advantages, including helping the Orthodontist with diagnosis, using it to examine an individual's growth through time by superimposing different structures and assessing the effectiveness of Orthodontic therapy. ^[1]

The assessment of facial growth prediction, direction and magnitude before the beginning of pubertal spurt is an important tool to know whether the resulting skeletal disharmony can be balanced according to the functional paradigm. ^[2,3] Early detection of developing skeletal malocclusions allows time and scope for interception with Orthopedic management. ^[4,5] There are many parameters given by investigators for the prediction of facial growth patterns among which the landmark study named Bjork's implant study^[6] is the most famous and has explained seven structural signs for the mandibular rotations. The anatomy of cervical vertebrae ^[7] has been related with future divergence pattern. Parameters like craniocervical angle ^[2], antegonial notch ^[8] and frontal sinus ^[9] have been known as predictors of future facial growth pattern. Sella turcica has also been studied to determine the prediction of skeletal malocclusions ^[10,11] especially in sagittal direction. However, there is limited data regarding the predictive relation between vertical facial growth and Sella turcica.

Sella turcica is divided into three segments, consisting of an anterior wall, a floor, and a posterior wall. ^[12] Morphologically, sella has many shapes, but have been classified for simplicity by Axelsson^[13]. Studies ^[14,15] have concluded that the early presence of sella turcica bridges during development is a key predictor of probable dental defects in adulthood. Henceforth, Sella Turcica can be an important key factor in predicting towards the development of hypodivergent and hyperdivergent growth patterns, since the neural crest cells for maxilla-mandibular development also originate from the sella region.

So, to establish a relation between the sellar region and the facial growth patterns and to examine the morphology of the sella turcica in hypodivergent and hyperdivergent growth pattern this study was undertaken.

MATERIALS & METHOD

This study included subjects reporting for Orthodontic treatment at the Department of Orthodontics, Indira Gandhi Government Dental College & Hospital, Jammu. The subjects were randomly selected and the pre-treatment lateral cephalograms were taken in a standard position with the Frankfort's plane parallel to the floor and teeth in maximum intercuspation with relaxed musculature. A total of 90 subjects were included in the study to achieve a 95% confidence level in the results. 90 patients were divided into two groups based on the growth pattern seen on the lateral cephalogram; the first group I (45 patients) had lateral cephalogram of subjects with hypodivergent growth pattern, while the second group II (45 patients) had lateral cephalograms of subjects with a hyperdivergent growth pattern. High and low mandibular plane angles were classified as SN-MP $>38^\circ$ for hyperdivergent growth pattern and SN-MP $<26^\circ$ for hypodivergent growth pattern. ^[16]

The inclusion criteria included: patients with age range between 13-18yrs, no history of previous Orthodontic treatment, patients with no systemic diseases, tampered lateral cephalogram The exclusion criteria included: subjects suffering from disorders of bone, nutritional deficiencies and endocrinal disturbances, any pathologies in the craniofacial region.

Each cephalogram was manually traced on a sheet of acetate paper with a tracing pencil under bright illumination. In order to assess the frequency of different sella morphologic forms across both growth trajectories different anatomical features, such as the Sella's length, depth, diameter, shape were measured after tracing the cephalogram on the acetate paper. length, depth and diameter were measured on the tracing paper using landmarks as described by Silverman and Kisling. ^[17,18] The shape of sella was categorized as described by Axelsson et al ^[13] as 1. Normal, 2. Oblique Anterior Wall, 3. Double Contour of floor, 4. Irregular Dorsum Sella, 5. Pyramidal

Shape. To avoid any bias, Single examiner traced and evaluated all the cephalograms.

RESULT

The data obtained was tabulated in the excel sheets and sent for statistical analysis using SPSS-23 software. Mean, standard deviation, standard error was calculated. Sella turcica dimensions between hypodivergent and hypodivergent growth patterns were compared using independent t-test. The prevalence of different Sella turcica morphologic shapes in two growth patterns was done using the chi-square test. The Results were taken as statistically significant at p-value ≤ 0.05 . The varied morphological shapes seen in lateral cephalograms are shown in Figure 1.

The table 1 and Graph 1 shows the p value ($p=0.0255$) for length showed a statistically significant difference between the two growth patterns, Hyperdivergent growth patterns had significantly higher mean, standard deviation, and standard error values than hypodivergent growth patterns. The p value for depth ($p=0.0619$) revealed a statistically insignificant difference between the two groups, but hyperdivergent growth pattern had significantly higher mean, standard deviation, and standard error values as compared to hypodivergent growth pattern. The p value ($p=0.0009$) for diameter revealed a statistically significant difference between the two groups, with hyperdivergent growth pattern showing a significant difference in mean and hypodivergent growth pattern showing a greater significant difference in standard deviation and standard error.

Graph 1 depicts the bar graph showing the difference in length, depth, and diameter of Sella turcica between hyperdivergent and hypodivergent growth pattern in the presence of mean and standard deviation. On the basis of length, hyperdivergent growth pattern showed a significantly greater difference than hypodivergent growth pattern. In terms of depth, hyperdivergent growth pattern outnumbered hypodivergent growth pattern by a significant margin. Hyperdivergent growth pattern had a significantly greater difference in diameter than hypodivergent growth pattern based on the diameter of sella turcica.

Table 2, Graph 2 shows the hypodivergent growth pattern had lesser variation in shapes when compared to hyper divergent growth pattern. The table demonstrated a statistically significant difference between the two groups, i.e., group I (Hypodivergent) and group II (Hyperdivergent). Oblique shape was next commonly prevalent after Normal shape in hyperdivergent Growth Pattern.

DISCUSSION

The common embryological origin is stated as a reason for the relationship between the sella turcica dimensions and skeletal morphology^[19] due to which any skeletal aberrations can be linked to the morphology of sella turcica. The intent of this research was to determine whether the length, depth, diameter and shape of sella has any association with the growth patterns and can be used as predictor for facial growth pattern in the vertical dimension.

The results of this study showed the dimensions of sella turcica to be increased in hyperdivergent subjects as compared to subjects with hypodivergent growth patterns with statistically significant differences in sella length ($p=0.0255^*$) and diameter ($p=0.0009^*$), the depth was also more in hyperdivergent growth pattern but was not statistically significant ($p=0.0619$). The reason for this significant finding may be due to the reason that an excessive growth of the posterior cranial fossa may cause hyperdivergence as it articulates with the mandible through the temporomandibular joint^[20] so an individual expressing greater vertical growth may have greater sella turcica dimensions.^[21]

The results of this study are in agreement with the results of a study^[22] which showed depth and diameter was increased in hyperdivergent growth pattern While in complete disagreement with the results of a study^[23] which in contrast, reported no significant differences in sella turcica dimensions among various growth patterns.

A study^[24] on an Indian sample concluded the sellar length was larger in the low angle group with no differences in the other sellar dimensions, which is divergent with the findings of the current work, where sella length, depth, diameter in hyperdivergent growth pattern was more as compared to hypodivergent growth pattern.

In present study 66.22% of hypodivergent subjects had normal sella morphology while in hyperdivergent group only 44.44% subjects had normal sella morphology. All the five sella morphologies were prevalent in the hyperdivergent growth pattern with mostly oblique and double contour morphologic shapes after the normal shape were more prevalent. A significant difference was found in sella turcica morphology and growth pattern which is in agreement with the results of a study [22] which also observed highest prevalence of normal shaped sella morphology in various growth patterns.

There are studies [25,26] which have investigated the relationship between vertical facial growth patterns and sella dimensions and no difference could be reported between sella parameters and facial types which is contrary to the results of present study where a significant difference in diameter and depth among the hyperdivergent and hypodivergent growth patterns was seen. The present study observed the values for length, diameter and depth were more in the hyperdivergent growth pattern as compared to hypodivergent growth pattern.

Such studies on Longitudinal basis should be performed with more sample size. There are studies which have pointed out that deviation in the normal sella morphology can be the predictor for future dental anomalies [27] based upon this statement, the findings of this study can be helpful in predicting and forecasting the growth pattern of a patient in growing stage which can help in timely deciding the treatment plan in Orthodontic patients especially the ones indicated for myofunctional and Orthopaedic appliances.

CONCLUSION

It can be inferred from the results of this study that the length, depth and diameter of sella turcica are greater in hyperdivergent growth pattern as compared to hypodivergent growth pattern. Morphologically the percentage of normal shape of sella was more in both the facial types. However, subjects with hyperdivergent growth pattern had more varied forms of sella morphology with oblique shape seen as second common prevalent as compared to hypodivergent growth pattern.

The findings of this study can act as a predictor for the vertical or horizontal growth pattern where in characteristics of sella in a growing child can help in anticipating the type of future facial growth pattern like short face and long face syndromes. Moreover, the findings of this study can be useful in genetic studies, anthropology and forensic medicine as well.

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Figure 1: Varied morphological shapes of sella turcica seen in different Facial growth patterns

Table 1: Comparison of hypodivergent and hyperdivergent growth pattern based on the length, depth, and diameter of the sella turcica using an independent t-test. The mean, standard deviation, and standard error were calculated to determine if there was a significant difference between the two groups.

Variables	Growth pattern	N	Mean	SD	SE	t-value	p-value
Length	Hyperdivergent	45	10.01	2.51	0.37	2.3333	0.0255*
	Hypodivergent	45	9.01	1.65	0.25		
Depth	Hyperdivergent	45	10.23	2.87	0.43	1.8673	0.0619
	Hypodivergent	45	9.22	2.22	0.33		
Diameter	Hyperdivergent	45	12.1	2.02	0.30	-4.2487	0.0009*
	Hypodivergent	45	10.44	2.67	0.40		

*p<0.05 indicates significant differences.

Graph 1: Comparison of hyperdivergent and hypodivergent growth patterns with mean length, depth & diameter of sella turcica.

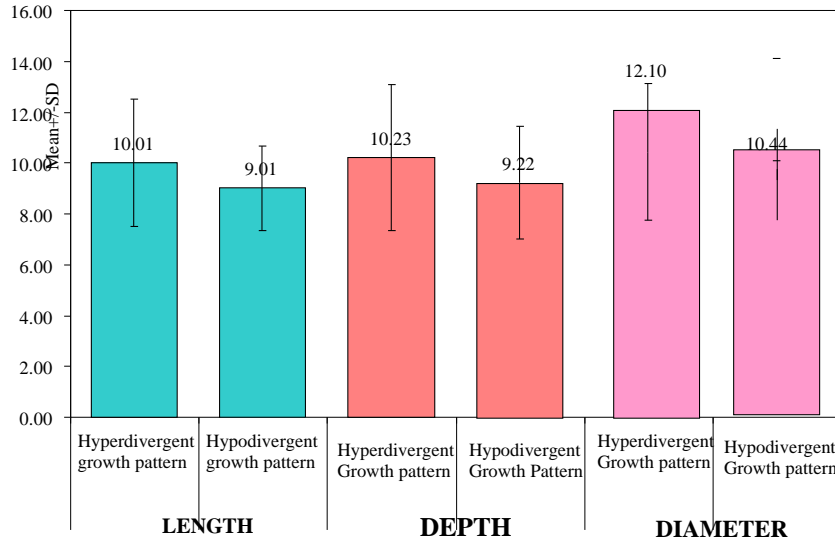


Table 2: The prevalence of different Sella turcica morphologic shapes in two growth patterns using the chi-square test.

Morphologic shapes	Hypodivergent growth pattern (Group I)	%	Hyperdivergent Growth pattern (Group II)	%
Normal	28	62.22	20	44.44
Double contour	3	6.67	5	11.11
Oblique	5	11.11	15	33.33
Irregular	9	20.00	2	4.44
Pyramidal	0	0.00	3	6.67
Total	45	100.00	45	100.00
Chi-square=11.2879, p=0.0235*				

*p<0.05 indicates significant association

Graph 2: Prevalence of different morphologic shapes of Sella turcica in two different growth patterns i.e., hypodivergent and hyperdivergent growth patterns.

