Original Article

DOI: 10.7860/JCDR/2023/62100.17876

Dentistry Section

Sellar Metrics and Morphology in Ethnic Dogra Population of Jammu Region- A Cross-sectional Cephalometric Study

FAISAL ARSHAD[1], AKSHAY GUPTA[2], PARVEEN AKHTAR LONE[3], RITESH GUPTA[4]

ABSTRACT

Introduction: Sella turcica is an important landmark seen during cephalogram tracing and evaluation. Its morphology varies in individuals, gender groups, age groups, and ethnicities.

Aim: This cephalometric study was done on a novel population of Dogra ethnicity residing in Jammu to determine the characteristics of sella and its correlation with the sagittal skeletal structures.

Materials and Methods: This study was a cross-sectional study done on cephalograms and included a total of 87 patients, equally classified as Skeletal Class-I, Class-II, Class-III, respectively. The pre-treatment profile cephalogram of the patient was obtained in a standardised method. Manual tracing of all the cephalograms was done on an acetate paper with a tracing pencil under optimal illumination. Area, size, shape, bridging of the sella were measured using a novel template and tabulated in excel sheet and sent for statistical analysis.

Results: The results showed mean area of sella was highest in skeletal Class-III (32.79±3.28 mm) followed by skeletal Class-I (28.31±1.63 mm) and least in skeletal Class-II subjects (23.27±2.91 mm). Skeletal Class-III had the greatest mean sella length (10.85±0.80 mm), depth (10.54±0.89 mm), Anteroposterior (AP) diameter (13.20±0.83 mm) followed by skeletal Class-I and least in Class-II. Normal sella turcica was prevalent among all the skeletal.

Conclusion: The dimensions of the sella obtained from this study provide an estimate about the morphology and size of sella in Dogra population thus providing knowledge to the local Orthodontist about the varied appearance of sella and helps in distinguishing the physiological and pathological patterns of sella.

Keywords: Bridging of the sella, Cephalogram, Ethnic variations

INTRODUCTION

One of the important anthropometric landmark used in cephalometric tracing and analysis for Orthodontic treatment management is sella turcica [1]. A very popular name for it is the "Turkish saddle" and is anatomically situated in the midline depression of the sphenoid bone's middle cranial fossa [2]. On a cephalogram it appears as a excavated cavity resembling a 'U' or an inverted omega (Ω) and hosts a very important glandular structure called the pituitary gland.

Considering sella turcica as the anatomical centre of cranial base, it is an important region during embryonic development. Sella turcica forms an important key in neural crest cell migration to the frontal, palatal and maxillary development. These neural crest cells along with the dental epithelial progenitor cells are involved in the formation and development of sella turcica and teeth. So any embryological malformations of the sella turcica may be associated with growth malformations of maxilla, palate and mandible occasionally involving the brainstem, thymus, thyroid and heart as well as glandular disorders [3,4].

In Orthodontics, the sella turcica has gained importance as a stable osseous landmark seen on lateral cephalometric radiographs [5] as well as in craniofacial superimposition techniques [6]. The sella point (s-point) given by Bjork is an exact centre of sella turcica and is a common Orthodontic marker used for cephalometric tracing and analysis of the maxilla and mandible [7].

Sella turcica has been vastly studied. Multiple research studies have been done on sellar area shape, size, depth [8,9], relationship of sagittal and vertical growth patterns with sella [10], bridging of sella [11-13]. Monozygotic twins [14] morphologic features of sella turcica in syndromic patients [15-18]. There are quite a number of studies on the various ethnicities which include Norwegians, Iranians, Nigerians, Polish, Saudi and South Indians regarding the different morphology and the size of sella turcica [19-23]. All the studies have revealed that variability in sella morphology exist in different ethnicities, and established norms for specific ethnic groups are lacking. As per literature search, none of the studies on sellar morphology has been reported on the Dogra ethnic group and that is why this study was taken to compare area, size, shape and incidence of bridging of sella in subjects belonging to Dogra ethnic group. The data from this study was then compared with studies done on other ethnic groups in the past.

The Dogras are an Indo-Aryan ethno-linguistic group speaking Dogri language. They primarily inhabit the Jammu region of Jammu and Kashmir, as well as neighbouring regions of Punjab, Himachal Pradesh, and north-eastern Pakistan. Their ancestral homeland is called Duggar. While many Dogra in Jammu and Kashmir practise Hinduism, a sizable minority adhere to islam, christianity, and buddhism [24-27].

MATERIALS AND METHODS

This was a cross-sectional descriptive study. The sample included subjects of Dogri origin derived from patients reporting for Orthodontic treatment to Department of Orthodontics, Indira Gandhi Government Dental College and Hospital, Jammu who were asked to provide details about their ethnic background. This study was completed over a period of one year and seven months from 30-04-2021 to 01-12-2022. All procedures performed in this study were in accordance with the ethical standards of the institutional research committee of Indira Gandhi Government Dental College and Hospital, Jammu. (No:IEC/IGGDC/45).

Inclusion criteria: 1) The age range of 12 to 27 years; 2) No facial or spinal abnormalities; 3) Radiographs with the clearest reproduction of the sella turcica area; 4) Both parents born in Jammu (Dogri speaking); 5) Healthy patients without any history of systemic diseases.

Exclusion criteria: 1) Signs of systemic illness (diabetes, metabolic disorder); 2) Undergoing any medical treatment that could interfere like patient on psychotic drugs; 3) Pregnancy; 4) Lateral Cephalograms without sharpness and contrast; 5) Patients suffering

from disorders of bone, nutritional deficiencies and endocrinal disturbances; 6) Any history of Orthodontic treatment/cleft repairs.

Keeping the power of study as 90% with alpha error of 5%, the total sample size was calculated to be 87. The total sample size was divided into three groups depending upon the skeletal classification with 29 subjects in each group. Group-I consisted of subjects with Class-I skeletal base, Group-II consisted of subjects with Class-II skeletal base, Group-III consisted of subjects with Class-III skeletal base.

Lateral cephalograms were divided into different classes based on A point, Nasion, B point (ANB) angle value WITS appraisal, YEN angle, Beta angle as depicted in [Table/Fig-1] [28-30].

Classes	ANB angle	WITS	YEN angle	Beta angle
Class-I	ANB angle ≤2°	BO 1 mm ahead of AO (male1 mm, female-0 mm	117-123 degrees	27-35 degrees
Class-II	ANB angle ≥4°	BO more behind of AO	>117-123 degrees	>35 degrees
Class-III	ANB angle ≤0	BO more forward of AO	<117-123 degrees	<27 degrees

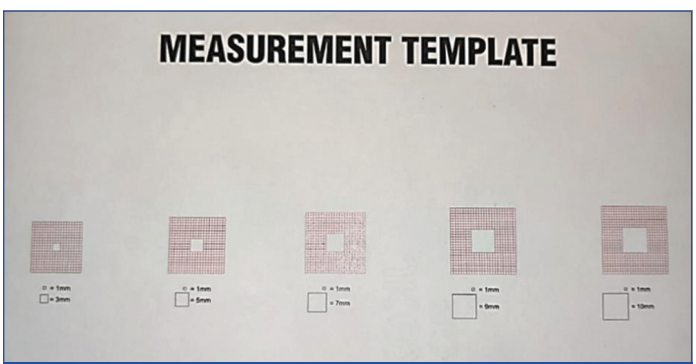
[Table/Fig-1]: Division of Lat. cephalograms on the basis of various parameters.

Pre-treatment lateral cephalogram of all the patients who were to undergo Orthodontic treatment were obtained in a standardised position with teeth in centric occlusion and Frankfort's plane parallel to the floor. All the lateral cephalograms were taken by the same trained operator using a cephalostat machine at 66 kV, 0.5 mA, and 18.7 s exposure time using X-ray films on 100% scale. Manual tracing of all the cephalograms was done on an acetate paper with a tracing pencil under optimal illumination.

Tracing of lateral cephalogram: Outline of the sella turcica on each lateral cephalometric radiograph was traced using lead pencil and acetate tracing paper, 0.003″ thick under sufficient illumination. Single investigator performed the measurements and assessed the shape and bridging of the sella. To assess intraoperator reliability, five lateral cephalograms were evaluated and re- evaluated after three weeks by the same investigator. The Intra-class Correlation Coefficient (ICC) showed values ranging from 0.61 and 0.71 between the two sets of measurements showing good agreement.

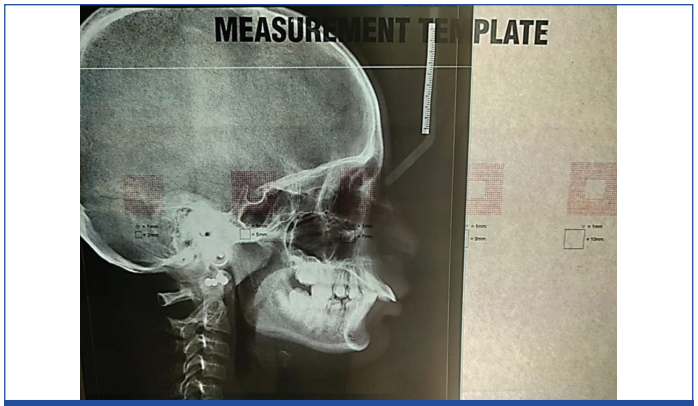
The following measurements of the sella turcica were made on the tracing sheet:

Area of the sella: The area was measured using a transparent novel template simulating graph paper measurements which was designed for measuring the area of sella having measuring squares of 3 mm, 5 mm, 7 mm, 9 mm to superimpose the traced sella directly on the measuring squares for ease of the area measurement, the measurements were made to the nearest of 0.1 mm [Table/Fig-2,3].

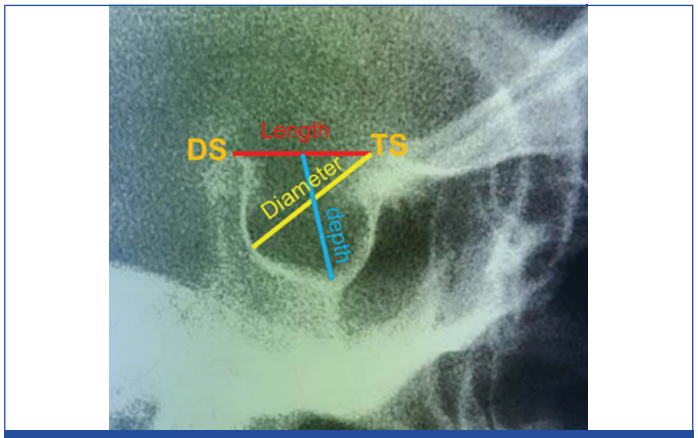


[Table/Fig-2]: Custom made transparent measurement template for measuring the area of sella.

Size of the sella: the size of the sella was measured using the landmarks by Silverman and Kisling [9,10] who used the Tuberculum Sella (TS), The Dorsum Sellae (DS), Base of the Pituitary Fossa (BPF) [Table/Fig-4].



[Table/Fig-3]: Superimposition of custom made transparent measurement template on the sella region of lateral cephalogram for measuring the area (mm^2).



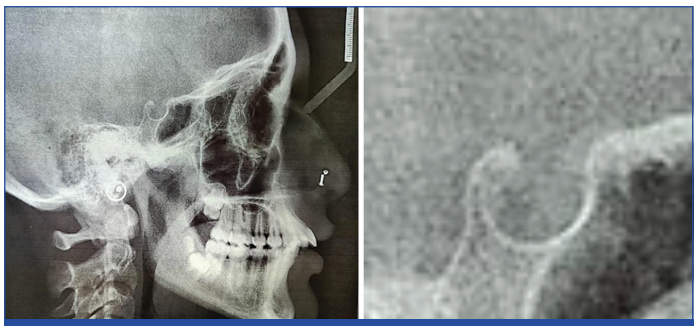
[Table/Fig-4]: Diameter (yellow), length (red), depth of sella (blue), Dorsum of sella (DS), Tuberculum Sella (TS).

Length of the sella turcica- Distance from TS to tip of DS

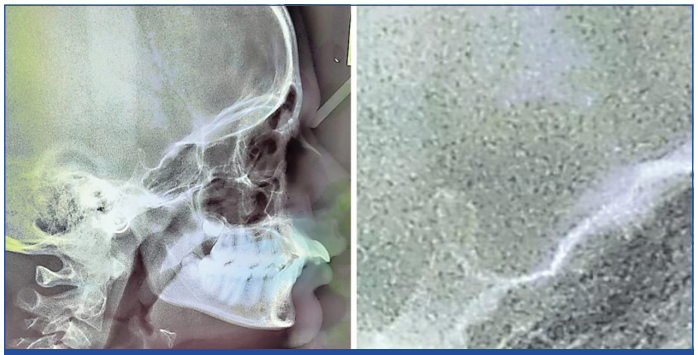
Depth of the sella turcica- Perpendicular from line above to the deepest point on the floor.

AP diameter of sella turcica- A line drawn from TS to the furthest point on the posterior inner wall of the fossa.

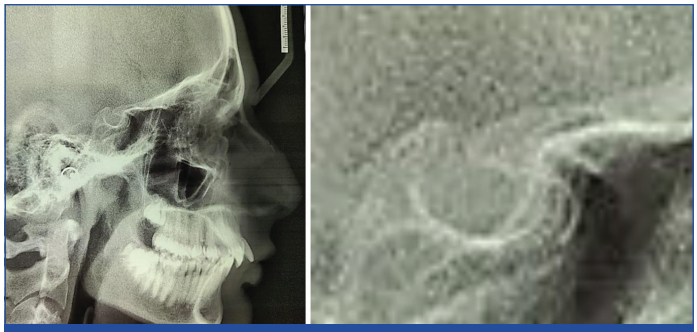
Shape of the sella [Table/Fig-5-11]: The shape of the sella was classified according to Axelsson S et al., [5] Classification as: 1) Normal; 2) Oblique anterior wall; 3) Double contour of floor; 4) Irregular dorsum sella; 5) Pyramidal shape; 6) Bridging of sella.



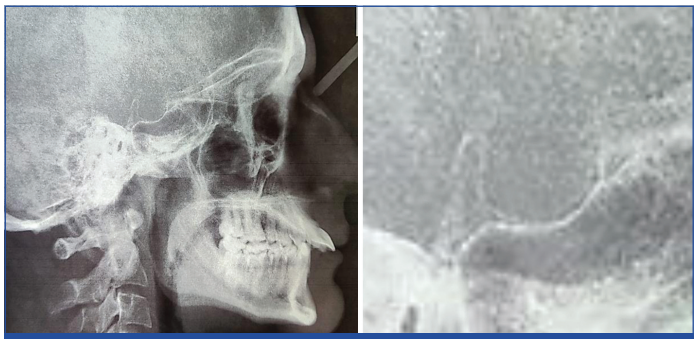
[Table/Fig-5]: Normal Sella morphology.



[Table/Fig-6]: Oblique anterior wall of Sella.

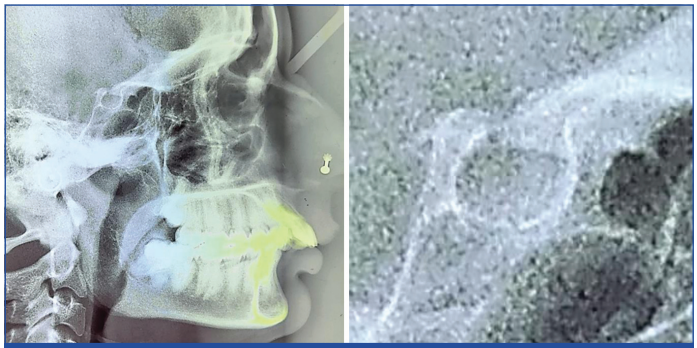


[Table/Fig-7]: Double contour of sella floor.

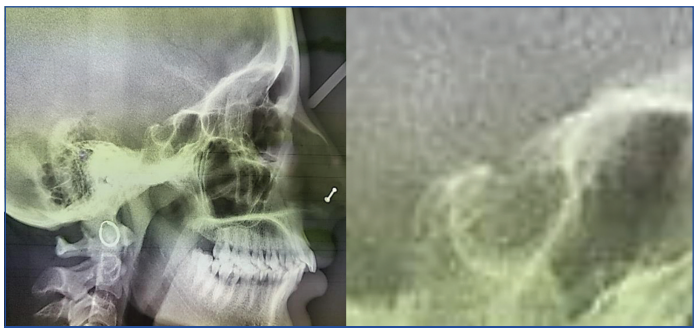


[Table/Fig-8]: Irregular dorsum sella.

[Table/Fig-9]: Pyramidal shape of sella.



[Table/Fig-10]: Bridging of sella (Type A).



[Table/Fig-11]: Bridging of sella (Type B).

The bridging of the sella: Bridging of sella was classified according to Becktor et al., into two groups [31]: Bridge is present: 1) Type A: Ribbon-Like fusion [Table/Fig-10]; 2) Type B: Extension of the anterior or posterior clinoid process [Table/Fig-11].

Incomplete Bridge- A partial calcification of interclinoid ligament is defined as incomplete bridge.

STATISTICAL ANALYSIS

All the lateral cephalograms were traced and values were tabulated in Excel sheet and sent for statistical analysis using SPSS 24. Mean, standard deviation, percentage wise, data was analysed. Various statistical tests done were: One-way ANOVA, Karl Pearson's correlation coefficient method. The ICC was done to determine the examiner reproducibility (0.8- 0.9- excellent reliability).

RESULTS

[Table/Fig-12] shows the mean age distribution skeletal Class-I, Skeletal-II and Skeletal-III. The overall mean age was 24.00±3.94 years.

Skeletal class	Mean±SD (in mm)
Class-I	23.31±1.58
Class-II	22.55±3.17
Class-III	26.14±5.26
Total	24.00±3.94
F-value	7.7219
p-value	0.0008*

[Table/Fig-12]: Mean and standard deviation of age taken in each skeletal group.

[Table/Fig-13] shows the mean area of sella turcica in three skeletal groups. The mean area was highest in skeletal Class-III followed by skeletal Class-I and skeletal Class-II which was statistically significant (p=0.0001).

Skeletal class	Mean±SD (mm)
Class-I	28.31±1.63
Class-II	23.27±2.91
Class-III	32.79±3.28
Total	28.12±4.74
F-value	90.1587
p-value	0.0001*
Pair wise comparisons by Tukeys multiple post-hoc procedures	
Class-I vs Class-II	p=0.0001*
Class-I vs Class-III	p=0.0001*
Class-II vs Class-III	p=0.0001*

[Table/Fig-13]: Mean area of sella turcica in three skeletal classes (I, II, III) using one-way ANOVA test.
*p<0.05 indicates significant differences

[Table/Fig-14] shows the mean length, depth, AP dimension of sella in skeletal Class-I, II and III. Skeletal Class-III had the greatest mean length, depth, AP diameter followed by skeletal Class-I, and skeletal Class-II.

	Length (mm)	Depth (mm)	AP dimension (mm)
Skeletal class	Mean	Mean	Mean
Class-I	8.97±0.51	8.38±0.61	12.34±1.00
Class-II	7.07±0.79	8.33±0.57	10.41±0.75
Class-III	10.85±0.80	10.54±0.89	13.20±0.83
Total	8.96±1.70	9.08±1.25	11.99±1.45
F-value	203.1738	92.7410	79.1889
p-value	0.0001*	0.0001*	0.0001*
Pair wise comparisons by Tukeys multiple post-hoc procedures			
Class-I vs Class-II	p=0.0001*	p=0.9529	p=0.0001*
Class-I vs Class-III	p=0.0001*	p=0.0001*	p=0.0009*
Class-II vs Class-III	p=0.0001*	p=0.0001*	p=0.0001*

[Table/Fig-14]: Mean of length, depth, Antero-Posterior (AP) dimension of three skeletal classes (I, II, III) by one-way ANOVA.
*p<0.05 indicates significant differences

The percentage wise prevalence of different sella shapes according to Axelsson S et al., is depicted in [Table/Fig-15]. The most prevalent

shape was normal sella turcica in skeletal Class-I (58.62%) followed by skeletal Class-II (44.83%) and then skeletal Class-III (37.93%). Notching of posterior wall of sella turcica was seen in mostly Class-II cases. While as oblique anterior wall was seen in the Class-III cases. In overall sample, the most prevalent shapes of sella were: Normal sella > Oblique anterior wall, > notching of posterior wall > double contour of floor > pyramidal shape > irregular.

Shape of sella	Class-I	Class-II	Class-III	Total
Double contour of floor	3 (10.34%)	3 (10.34 %)	6 (20.69%)	12 (13.79 %)
Irregular	1 (3.45 %)	0 (0 %)	0 (0%)	1 (1.15 %)
Normal sella turcica	17 (58.62%)	13 (44.83%)	11 (37.93%)	41 (47.13%)
Notching of posterior wall	3 (10.34 %)	10 (34.48%)	0 (0 %)	13 (14.94%)
Oblique anterior wall	3 (10.34 %)	3 (10.34%)	12 (41.38%)	18 (20.69%)
Pyramidal shape	2 (6.90 %)	0 (0%)	0 (0 %)	2 (2.30%)
Total	29 (100%)	29 (100%)	29 (100%)	87 (100%)

[Table/Fig-15]: Prevalence of sella shapes in Class-I, II, III skeletal bases. Chi-square=22.8519, p=0.0113

[Table/Fig-16] shows the overall bridging of sella was missing in 58.62% of the subjects and present in 41.38%. Bridging of sella was present in Class-II >Class-III >Class-I.

Bridging of sella	Class-I	Class-II	Class-III	Total
Bridging Absent	23 (79.31%)	10 (34.48%)	18 (62.07%)	51 (58.62%)
Bridging Present	6 (20.69%)	19 (65.52%)	11 (37.93%)	36 (41.38%)
Total	29(100%)	29 (100%)	29 (100%)	87 (100%)

[Table/Fig-16]: Bridging of sella turcica in three skeletal classes (I, II, III).

[Table/Fig-17] shows the cases where the bridging is present and further evaluation for type of bridging whether complete or partial bridging is present. In overall sample, the Bridging of sella was partial in most of the cases. Bridging of sella was seen both complete and partial in Class-II followed by Class-III and least in Class-I cases. Partial bridging (48.28%) was more prevalent in Class-II skeletal base with bridging of sella.

Type of bridging	Class-I	Class-II	Class-III	Total
Complete	0 (0%)	5 (17.24%)	1 (3.45%)	6 (6.90%)
Partial	6 (20.69%)	14 (48.28%)	10 (34.48%)	30(34.48%)

[Table/Fig-17]: Complete and partial bridging of sella turcica in three skeletal classes (I, II, III).

DISCUSSION

This is the first study to have investigated the sellar characteristics of ethnic Dogra population in skeletal Class-I, II, III subjects which included determining the area, size, shape and bridging of sella. The results of the study revealed the overall mean of the sella area in 90 subjects was 28.12±4.74 mm, however the mean area was highest in skeletal Class-III (32.79±3.28 mm) followed by skeletal Class-I (28.31±1.63 mm) and skeletal Class-II (23.27±2.91 mm). The results of this study are in agreement with the three dimensional Cone-beam Computed Tomography (CBCT) study by Luong HM et al., which showed Class-III subjects had larger sellar volume compared to Class-I and Class-II as well as study conducted on the Iranian population by Moslemzadeh SH et al., who reported a greater length of sella in Class-III individuals [32,33] and well in alignment with other studies which included Saudi population as well as skeletal Class-I, II and III which have shown significant relationship between sella dimensions and skeletal sagittal relations [23,33,34].

In a research [23] conducted by Alkofide EA on Saudi subjects with Class-I, II, III skeletal bases, the morphology of the sella turcica appeared to be normal in shape in the majority of subjects (67 per cent), which is in partial agreement with the results of the current Dogra ethnic study where also majority of subjects (47.13%) had normal sella morphology followed by oblique anterior wall (20.69%) which is contrary to the Saudi subjects which reported only 9.4% subjects with oblique wall and further, the present study showed the notching of posterior wall to be 14.94% and double contour of the floor to be 13.79% which is in alignment with the results of the study by Axselsson S et al., [5].

The normal shape of Sella was more prevalent in Class-I (58.62%) followed by Class-II (44.83%) and least in Class-III (37.93). Notching of posterior wall was seen in 34.48 % subjects which was second highest after the normal shape (44.83%) in Class-II skeletal base which is in agreement with the study on sella morphology of subjects in south Indian population which revealed Class-II skeletal base had more notching of posterior wall which was highest in their overall sample equal to 11%, while only 2% notching was seen in Class-I skeletal subjects which is also contrary to present study where notching had second highest prevalence in Class-I [35]. In the present study on Dogra ethnicity, oblique anterior wall was more prevalent (41.38%) in the Class-III subjects followed by normal shape (37.93%) while Class-II showed prevalence of normal shape of sella (44.83) followed by notching of posterior wall (34.48%) and in Class-I subjects, the normal shape was highly prevalent. The present study reported very less pyramidal shape (2.30%) of sella which is consistent with the findings of a study done on North Indian population [36].

In his study, Camp JD measured the mean dimensions of the normal sella turcica in 500 healthy [37], adult individuals, without any demographic classification and found mean of 10.6 mm in the AP direction and 8.1 mm in depth which almost coincided with the results of his another study done on direct measurement of anatomic specimens in autopsy study [38], while in the present study on Dogra ethnicity, the dimensions were quite higher in AP dimension (11.99±1.45), depth (9.08±1.25) and mean length (8.96±1.70) but quite close to the dimensions reported by Kantor ML and Norton LA in their cephalometric study on multi racial subjects belonging to African Americans, Hispanics, and others with a mean age of 14.8 years which revealed the sella turcica mean length was 10.9±1.8 mm, while the mean depth was 7.6±1.7 mm [39].

The present study revealed the highest dimension in Class-III skeletal subjects with mean length of 10.85±0.80 mm, depth of 10.54±0.89 mm, AP diameter of 13.20±0.83 mm followed by skeletal Class-I: length (8.97±0.51), depth (8.38± 0.61 mm), AP dimension (12.34±1.0 mm). Skeletal Class-II had the lowest dimensions with length (7.07±0.79), depth (8.33±0.57), AP dimension (10.41±0.75) of sella as compared to Class-I and III. These results are in agreement with the study of Alkofide EA on Saudi subjects who revealed that larger diameter values were present in the skeletal Class-III subjects [23], while smaller diameter sizes were apparent in Class-II subjects as well as results of a study by Chauhan P et al., on south Indian population who found the linear dimensions greater in Class-III followed by Class-I then Class-II [36].

Studies have reported calcification of diaphragma sella which is radiographically called as “bridging” or “roofing” in 12 percent and 11 percent and the structures that seem to be associated with the greatest variation in sella are the anterior and posterior clinoid processes [38,39]. While the percentage of bridging in the present study was 41.38% which was much higher comparatively and the partial type of bridging was more prevalent which was more associated with skeletal Class-II malocclusion similar to the other studies [32,35].

Limitation(s)

The limitation of the present study was that sella morphology in relation to male and female population was not seen.

CONCLUSION(S)

This study showed the overall presence of normal sella in majority of the subjects followed by oblique anterior wall and double contour of the floor. Pyramidal shape of sella was least prevalent. Skeletal Class-III subjects had greater dimensions in area, length, depth, and diameter while Class-II skeletal base had the least dimensions. Overall, the bridging of the sella was present in 41.38% of the subjects and was more prevalent in Class-II skeletal base (65.52%), with mostly partial bridging (48.28%). The average dimension of sella in Dogra population were as follows: area was 28.12 mm, length was 8.96 mm, depth was 9.08 mm, and AP dimension was 11.99 mm. More multicentric studies with an increased sample size should be undertaken.

REFERENCES

[1] Cederberg RA, Benson BW, Nunn M, English JD. Calcification of the interclinoid and petroclinoid ligaments of sella turcica: A radiographic study of the prevalence. Orthod Craniofac Res. 2003;6:227-32.
[2] Mutluer S. Sella turcica. Childs Nerv Syst. 2006;22:333.
[3] Kjaer I. Orthodontics and foetal pathology: A personal view on craniofacial patterning. Eur J Orthod. 2010;32:140-47.
[4] Leonardi R, Barbato E, Vichi M. A sella turcica bridge in subjects with dental anomalies. Eur J Orthod. 2006;28:580-85.
[5] Axelsson S, Storhaug K, Kjær I. Post-natal size and morphology of the sella turcica. Longitudinal cephalometric standards for Norwegians between 6 and 21 years of age. Eur J Orthod. 2004;26:597-604.
[6] Standerwick R, Roberts E, Hartsfield J Jr, Babler W, Kanomi R. Cephalometric superimposition on the occipital condyles as a longitudinal growth assessment reference: I-point and I-curve. Anat Rec (Hoboken). 2008;291(12):1603-10.
[7] Björk A. The face in profile. An anthropological x-ray investigation on Swedish children and conscripts. Svensk Tandläkare Tidskrift. 1947;40:180.
[8] Nagaraj T, Shruthi R, James L, Keerthi I, Balraj L, Goswani R. The size and morphology of sella turcica: A lateral cephalometric study. J Med Radiol Pathol Surg. 2015;1:03-07.
[9] Silverman FN. Roentgen standards for size of the pituitary fossa from infancy through adolescence. Am J Roentgneol Radium ther Nucl Med. 1957;78:451-60.
[10] Kisling E. Cranial morphology in Down's syndrome. A comparative roentgen cephalometric study in adult males. Munksgaard. Copenhagen. 1966.
[11] Yaşa Y, Büyük SK, Benkli YA, Arslan A, Topbaşı NM. The size and shape of the sella turcica in adolescent Orthodontic patients with different vertical growth patterns. Clin Dent Res. 2017;41(1):03-09.
[12] Valizadeh S, Shahbeig S, Mohseni S, Azimi F, Bakhshandeh H. Correlation of shape and size of sella turcica with the type of facial skeletal Class-In an Iranian group. Iran J Radiol. 2015;12(3):16059.
[13] Marşan G, Öztaş E. Incidence of bridging and dimensions of sella turcica in Class-I and III Turkish adult female patients. World J Orthod. 2009;10(2):99-103.
[14] Brock-Jacobsen MT, Pallisgaard C, Kjaer I. The morphology of the sella turcica in monozygotic twins. Twin Res Hum Genet. 2009;12:598-604.
[15] Takada K, Petdachai S, Sakuda M. Changes in dentofacial morphology in skeletal Class-III children treated by a modified maxillary protraction headgear and a chin cup-a longitudinal cephalometric appraisal. Eur J Orthod. 1993;15(3):211-21.
[16] Kjaer I, Fischer-Hansen B. Human fetal pituitary gland in holoprosencephaly and anencephaly. J Craniofac Genet Dev Biol. 1995;15(4):222-29.
[17] Kjaer I, Keeling JW, Reintoft I, Nolting D, Fischer Hansen B. Pituitary gland and sella turcica in human trisomy 21 fetuses related to axial skeletal development. Am J Med Genet. 1998;80(5):494-500.
[18] Kjaer KW, Hansen BF, Keeling JW, Nolting D, Kjaer I. Malformations of cranial base structures and pituitary gland in prenatal Meckel syndrome. APMIS. 1999b;107:937-44.
[19] Valizadeh S, Shahrzad S, Mohseni S. Correlation of shape and size of sella turcica with the type of facial skeletal Class-In Iranian group. Iran J Radiol. 2015;12(3):e16059.
[20] Perez IE, Chavez AK, Ponce D. Frequency of sela turcica bridge and clinoid enlargement in lateral cephalometric plain film radiography from Peruvians. Int J Morphol. 2013;31(2):373-77.
[21] Shah AM, Bashir U. The shape and size of the sella turcica in skeletal Class-I, II and III in patients presenting at Islamic International Dental Hospital, Islamabad. Pakistan Oral & Dental Journal. 2011;31(1):104-10.
[22] Ize-Iyamu IN. Sella turcica shape, linear dimensions and cervical vertebrae staging in pre-orthodontic patients in Benin City, Nigeria. Sahel Med J. 2014;17(4):151-58.
[23] Alkofide EA. The shape and size of the sella turcica in skeletal Class-I, Class-II, and Class-III Saudi subjects. Eur J Orthod. 2007:29(5);457-63.
[24] Barot R. Social anthropology, ethnicity and family therapy. J Fam Ther. 1988;10:271-82.
[25] Jyoteeshwar P, Chand SD. Cultural Heritage of the Dogras. 1980; Light & Life Publishers.
[26] Pike J. Punjab Regiment. Globalsecurity.org. Accessed on 22 May 2022.
[27] The People-Dogras. Webindia123.com. Accessed on 22 May 2022.
[28] Jacobson A. The "Wits" appraisal of jaw disharmony. Am J Orthod. 1975;67:125-38.
[29] Neela PK, Mascarenhas R, Husain A. A new sagittal dysplasia indicator: The Yen angle. World J Orthod. 2009;10:147-51.
[30] Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: The beta angle. Am J Orthod Dentofacial Orthop 2004;126:100-05.
[31] Teal JS. Radiology of the adult sella turcica. Bull Los Angeles Neurol Soc. 1977;42:111-74.
[32] Moslemzadeh SH, Moghaddam N, Moghaddam SF, Rafighi A, Ghojazadeh M, Rasouli F. Relationship between bridging and dimensions of sella turcica and antero-posterior skeletal malocclusions in children. Iran J Orthod. 2016;11(2):5738.
[33] Luong HM, Ahn JH, Bollu P, Chenin D, Chaudry K, Pourhamidi J. Sella turcica variations in skeletal Class-I, Class-II and Class-III adult subjects: A CBCT study. J Dent Oral Biol. 2016;1(3):01-06.
[34] Meyer MP, Reuther T, Stellzig EA. Bridging of the sella turcica in skeletal Class-III subjects. Eur J Orthod. 2010;32(2):148-53.
[35] Ani S, James J, Prasanth SP. Morphology of Sella Turcica in Skeletal Class-II Subjects. J Res Adv Dent. 2015.
[36] Chauhan P, Kalra S, Mongia SM, Ali S, Anurag A. Morphometric analysis of sella turcica in North Indian population: A radiological study. Int J Res Med Sci 2014;2:521-26.
[37] Camp JD. The normal and pathological anatomy of the sella turcica as revealed by roentgenograms. American Journal of Roentgenology. 1924;12:143-56.
[38] Tetradis S, Kantor ML. Prevalence of skeletal and dental anomalies and normal variants seen in cephalometric and other radiographs of orthodontic patients. Am J Orthod Dentofacial Orthop. 1999;116(5):572-77.
[39] Kantor ML, Norton LA. Normal radiographic anatomy and common anomalies seen in cephalometric films. Am J Orthod Dentofacial Orthop. 1987;91(5):414-26.

PARTICULARS OF CONTRIBUTORS:
1. Registrar, Department of Orthodontics, Indira Gandhi Government Dental College and Hospital, Jammu and Kashmir, India.
2. Professor and Head, Department of Orthodontics, Indira Gandhi Government Dental College and Hospital, Jammu and Kashmir, India.
3. Professor and Head, Department of Oral and Maxillofacial Surgery, Indira Gandhi Government Dental College and Hospital, Jammu and Kashmir, India.
4. Dental Surgeon, Department of Orthodontics, Indira Gandhi Government Dental College and Hospital, Jammu and Kashmir, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Faisal Arshad,
Registrar, Department of Orthodontics, Indira Gandhi Government Dental College and Hospital, Jammu and Kashmir, India.
E-mail: faisarshad@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Dec 14, 2022
- Manual Googling: Mar 10, 2023
- iThenticate Software: Apr 13, 2023 (14%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Dec 06, 2022**
Date of Peer Review: **Jan 16, 2023**
Date of Acceptance: **Apr 17, 2023**
Date of Publishing: **May 01, 2023**