



The Shape and Size of the Sella Turcica in Turkish Subjects with Different Skeletal Patterns

Rabia Merve Celik Karatas
Afyon Kocatepe University, TURKEY

F. Betül Kahraman
Necmettin Erbakan University, TURKEY

Mehmet Akin
Selcuk University, TURKEY

•Received 08 September 2015 •Revised 11 November 2015 •Accepted 17 November 2015

The aim of this study was to describe the shape and measure the size of the sella turcica in Turkish subjects with different skeletal types. Lateral cephalometric radiographs of 150 patients (75 females and 75 males) were taken and distributed according to skeletal classification; 50 Class I, 50 Class II, and 50 Class III. The sella turcica on each radiograph was analyzed and measured to determine the shape of the sella, in addition to the linear dimensions of length, depth, and diameter. In statistical comparison, Independent sample t- test or Mann-Whitney U test, one-way analysis of variance and post-hoc Tukey HSD, and Fishers Exact tests were used at $p < 0.05$ level. The statistical analysis showed that there were no significant differences in linear dimensions of the sella turcica between genders. Normal shape of the sella turcica was seen in the majority of the subjects (68,7%), regardless of gender, age or skeletal type. When skeletal type was compared with sella size, a significant difference was found in the diameter of sella between the Class I and Class II subjects. Larger diameter values were present in the skeletal Class I subjects, while smaller diameter sizes were apparent in Class II subjects. Sella shape and dimensions reported in the current study can be used as reference standards for further investigations involving the sella turcica area in Turkish subjects.

Keywords: sella turcica, shape, size, skeletal classification

INTRODUCTION

Several landmarks within the cranium have been used as reference points to evaluate cephalometric radiographs. Sella point (the center of the sella turcica) constitutes an important reference point in cephalometric analyses of the dentofacial and neurocranial morphology. This point is located in the midpoint of the sella turcica, housing the pituitary gland in the cranial base. The anterior lobe (adenohypophysis), the intermediate lobe, and the posterior lobe (neurohypophysis) form this gland (1).

Correspondence: Rabia Merve Celik Karatas,
Afyon Kocatepe University, Faculty of Dentistry, Department of Orthodontics, 03200,
Afyonkarahisar, TURKEY.
E-mail: dtrmerve@gmail.com
doi: 10.12973/ejms.2015.145p

Altered shape of the sella turcica could cause abnormality or pathology in the gland, such as disturbance in the regulation of secretion of glandular hormones; prolactin, growth hormones, thyroid-stimulating hormone, follicular stimulating hormone, etc. (2-4). This disturbance can cause growth problems (acromegaly or gigantism, Cushing's disease, hyperthyroidism, amenorrhea and galactorrhea, and menstrual disturbances) (2, 3). Cephalometric radiographs of subjects with these conditions can show an abnormal sella size or shape, so we can think about subjects with an abnormal sella turcica may have an undetected underlying disease (5-7). Several studies have reported that morphological appearance of the sella turcica is established in the early embryonic structure. Kjaer et al. (8) reported that a foetus with holoprosencephaly with the sella turcica malformations. Russell and Kjaer reported that children with fragile X and Down syndrome showed sella turcica shape malformation in prenatal period and continued postnatal period (9, 10). Therefore, we must know the normal morphology of the sella turcica to determine unusual appearance of sella. Morphology may have differences among individuals. Normal standards will help to eliminate abnormality of sella turcica. The aim of this study was to describe the shape and measure the size of the sella turcica in Turkish subjects with different skeletal types.

MATERIAL AND METHODS

This retrospective study's samples were comprised pretreatment lateral cephalometric radiographs of 150 patients (75 females 13.08±1.58 years old and 75 males 13.24±1.44 years old) obtained from archive of the Department of Orthodontics of X University in X. Only radiographs that had the clearest visual acuity of the sella turcica area were selected. The cephalometric radiographs were distributed according to skeletal class and gender; 50 Class I, 50 Class II, and 50 Class III cases were collected with an equal distribution between males and females in each class (25 females and 25 males). Table 1 shows the mean ages of genders. According to the Steiner's analysis: ANB (A point, nasion, B point) angle determines whether the skeletal relationship between the maxilla and mandible is a normal (skeletal class I relationship (+ 2 degrees), a skeletal Class II (+4 degrees or more), or skeletal class III (0 or negative) and the ANB angle was the basis for classification of skeletal type into Class I, Class II, or Class III at this study.

Table 1. Distribution of genders.

Gender	N	Mean	SD
Female	75	13,08	1,58
Male	75	13,24	1,44

The sella turcica on each cephalometric radiograph was measured on Adobe Acrobat 7.0 professional version 7.0.0 computer program by the same author. Silverman (11) and Kisling (12) methods were used to measure of the linear dimensions of sella turcica. According to the this method; the length of sella turcica (distance from the tuberculum sella to the tip of the dorsum sella), the depth of the sella turcica (perpendicular from the line above to the deepest point on the floor) and anteroposterior diameter of sella turcica (distance from the tuberculum sella to the furthest point on the posterior inner wall of the fossa) were measured (Figure 1).

The analysis of the morphological variations of the sella turcica was evaluated with a method described by Axelsson et al. (18). Five distinct morphological types were seen: oblique anterior wall, sella turcica bridging, double contour of the floor, irregularity in the posterior part of the dorsum sella and pyramidal shape of the dorsum sella (Figure 2).

In statistical comparison, Independent sample *t*-test, one-way analysis of variance and post-hoc Tukey HSD, and Fishers Exact tests were used at $p < 0.05$ level.

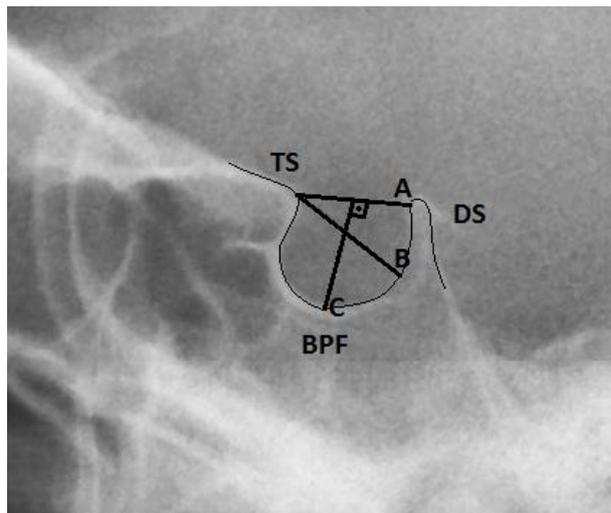


Figure 1. Normal sella turcica morphology and reference lines used for measuring sella size: TS, tuberculum sella; DS, dorsum sella; BPF, base of the pituitary fossa. A: length of sella. B: anteroposterior diameter of sella. C: depth of sella.

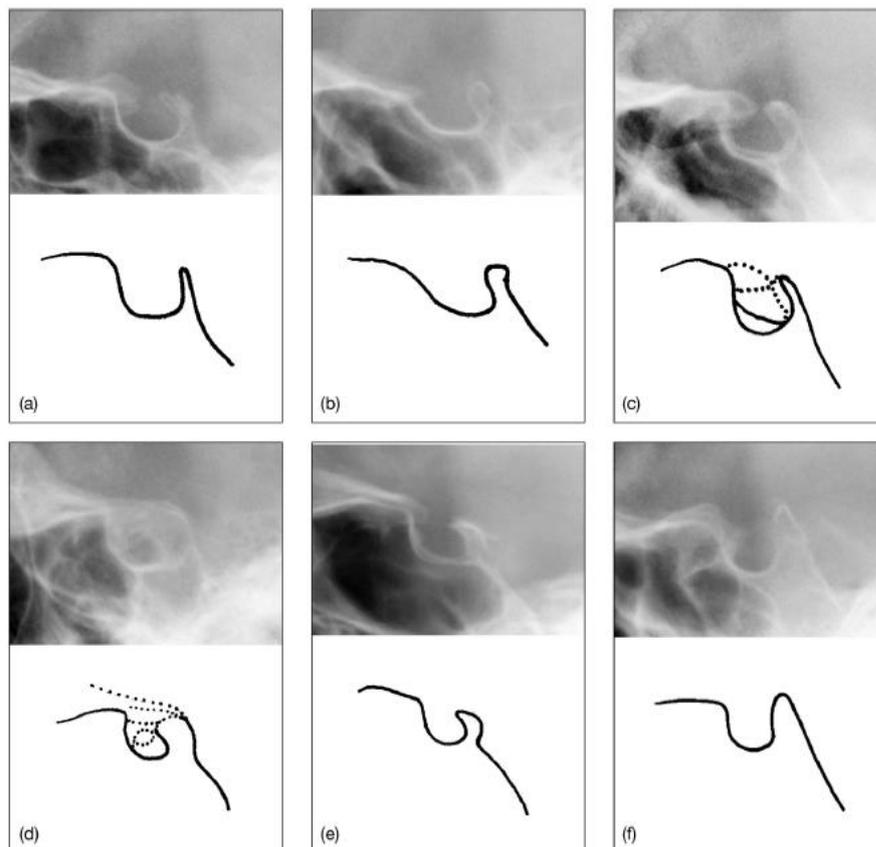


Figure 2. The different types of sella turcica: (a) normal sella turcica, (b) oblique anterior wall, (c) double contour of the floor, (d) sella turcica bridge, (e) irregularity in the posterior part of the sella turcica, (f) pyramidal shape of the dorsum sellae (Axelsson et al 2004).

RESULTS

The statistical analysis showed that normal shape of the sella turcica was seen in the majority of the subjects (68,7%), regardless of gender, age or skeletal type (Table 2, Figure 3). 31,3 % of the subjects had variation in the morphology of the sella turcica; 6,7% of the subjects had irregular dorsum sella, 16% of the subjects had oblique anterior wall and 6% of the subjects had pyramidal shape.

When skeletal type was compared with sella size, a significant difference was found in the diameter of sella between the skeletal Class I and Class II subjects in females ($p=0.017$), however there were no significant differences in the males. Larger diameter values were found in the skeletal Class I subjects than Class II subjects in females (Table 3).

When compared the linear dimensions of the sella turcica, there was no difference between the genders. Data from the cephalometric measurements of the sella turcica for females and males with means, standart deviations and the level of statistical significance between females and males are presented in Table 4.

Table 2. Frequency distribution of sella turcica type.

Sella type	Frequency	Percentage (%)
Normal sella turcica	103	68,7
Oblique anterior wall	24	16
Sella turcica bridge	2	1,3
Double contour	2	1,3
Irregular dorsum sella	10	6,7
Pyramidal shape	9	6
Total	150	100

Table 3. Comparison of the sella shapes.

		class I	class II	class III		
		Mean \pm SD	Mean \pm SD	Mean \pm SD	P value (sign)	Posthoc Tukey
Female	Length	0,87 \pm 0,13	0,83 \pm 0,11	0,87 \pm 0,17	0,496	
	Depth	0,83 \pm 0,18	0,76 \pm 0,08	0,81 \pm 0,10	0,154	
	AP Diameter	1,20 \pm 0,15	1,11 \pm 0,09	1,17 \pm 0,11	0,022*	class I / class II (0,017)
Male	Length	0,92 \pm 0,18	0,89 \pm 0,19	0,87 \pm 0,27	0,771	
	Depth	0,80 \pm 0,14	0,78 \pm 0,14	0,81 \pm 0,10	0,692	
	AP Diameter	1,13 \pm 0,19	1,12 \pm 0,16	1,16 \pm 0,18	0,75	
Total	Length	0,89 \pm 0,16	0,86 \pm 0,16	0,87 \pm 0,22	0,661	
	Depth	0,81 \pm 0,16	0,77 \pm 0,11	0,81 \pm 0,10	0,153	
	AP Diameter	1,17 \pm 0,17	1,12 \pm 0,13	1,15 \pm 0,15	0,167	

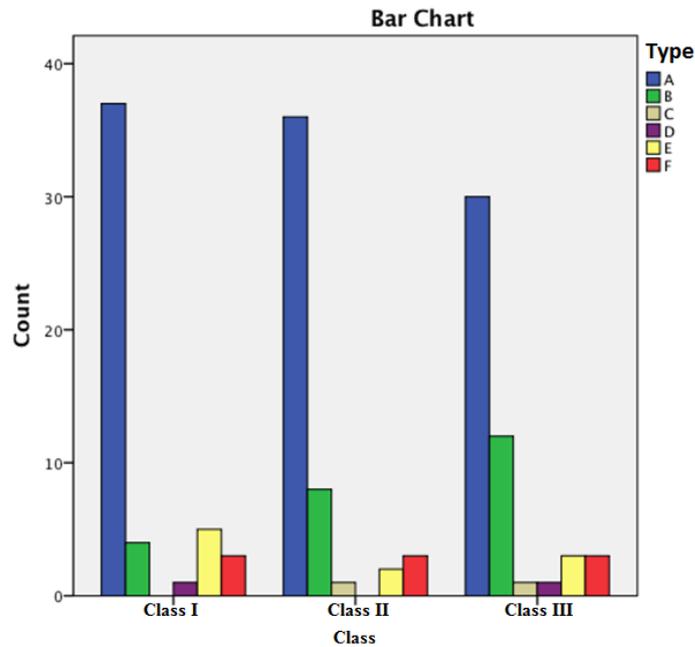


Figure 3. Distribution of sella turcica types between classes . (a) normal sella turcica, (b) oblique anterior wall, (c) double contour of the floor, (d) sella turcica bridge, (e) irregularity in the posterior part of the sella turcica, (f) pyramidal shape of the dorsum sellae (Axelsson et al 2004).

Table 4. Data from the cephalometric measurements of the sella turcica for females and males.

		Female	Male	
		Mean ± SD	Mean ± SD	P value (sign)
Class I	Length	0,87±0,13	0,92±0,18	0,274
	Depth	0,83±0,18	0,80±0,14	0,636
	AP Diameter	1,20±0,15	1,13±0,19	0,133
Class II	Length	0,83±0,11	0,89±0,19	0,181
	Depth	0,76±0,08	0,78±0,14	0,441
	AP Diameter	1,11±0,09	1,12±0,16	0,818
Class III	Length	0,87±0,17	0,87±0,27	0,985
	Depth	0,81±0,10	0,81±0,10	0,885
	AP Diameter	1,17±0,11	1,16±0,18	0,77

DISCUSSION

In this prospective study, the shape and size of the sella turcica were investigated in a population of healthy Turkish males and females with different facial skeletal types.

Measurements of the sella turcica and examination of its morphology are important for the assessment of pathology in the pituitary gland. Many researchers has been reported the shape variation in the sella turcica (1, 11-15).

Gordon and Bell (11) examined the radiographs of children 1-12 years of age and classified the sella turcica into circular, oval, and flattened, or saucer shaped. They

concluded that most of the subjects had either a circular or oval-shaped sella. In Axelsson et al.'s study (16), the shape of the sella turcica was categorized into six main types; normal sella turcica, oblique anterior wall, double-contoured sella, sella turcica bridge, irregularity (notching) in the posterior part of the sella, and pyramidal shape of the dorsum sellae. Their results show that a normal sella turcica morphology was seen in two-thirds of the subjects, while the remainder showed dysmorphological appearances. An alteration in the shape of the sella turcica can be misleading since it may be present in 'normal' subjects (12, 14, 15), as well as in medically compromised subjects such as those with spina bifida (17) and craniofacial deviations (9, 18, 19). In our study, approximately 69% of the subjects appeared to have a normal shaped sella turcica, while 31% presented with different aberrations. This is in agreement with Axelsson et al. (16) and Alkofide(1). Our finding about irregular notching of the dorsum sella (8%) was almost similar with this two studies (11%).

The presence of a sella turcica bridge in normal individuals is not uncommon and has been shown to occur in 5.5 - 22% of subjects (12, 14-16), with an increase in occurrence in patients with craniofacial deviations (18). In the current study, a sella bridge was found in only 1.1 per cent of the subjects which is much lower than that previously reported. An oblique anterior wall has also been documented in normal (16), and medically compromised subjects such as children with lumbosacral myelomeningocele and Seckel syndrome (9, 17, 19). The current study showed only 9.4 per cent of subjects with an oblique anterior wall compared with 26 per cent found by Axelsson et al. (16).

When determining if any differences existed in the present study between males and females in terms of sella turcica size, no significant gender differences were found. Similar findings were reported by Israel (20) who concluded that sella turcica size in young adult males and females were almost the same.

Few studies have compared the skeletal type of individuals with their sella turcica size to determine if a relationship exists. Preston (21) divided cephalometric radiographs of subjects into three groups according to age 5-9, 10-14, and 15-17 years, and according to their skeletal/facial type: Class I, Class II, and Class III. His findings showed no statistically significant correlation between facial type and the mean sella area of the pituitary fossa.

In the Alkofide's study (1), there were significant differences between skeletal Class II and Class III patients. In this study, the higher values observed in Class III patients than Class II patients. In our study, a significant difference was observed between skeletal Class I and Class II patients in terms of the sella turcica diameter. An increase in diameter size appears to be more common in Class I subjects, while a reduced diameter size is more prevalent in Class II individuals.

The linear dimensions obtained from the current study can be used to approximate the size of the pituitary gland, and may aid the clinician when confronted with an abnormally large sella area on lateral cephalograms. The orthodontist should also be familiar with the different shapes of the sella area, in order to help distinguish pathology from normal developmental patterns.

CONCLUSIONS

1. Approximately 69% of the investigated subjects had a normal sella shape.
2. No significant differences in size of the sella could be found between genders.
3. When sella size was compared with skeletal type, a significant difference was found in diameter size between Class I and Class II subjects. Smaller diameter values were present in skeletal Class II subjects, while larger diameter sizes were apparent in Class I subjects.

4. The results of the present study of sella shape and size may be used as reference standards for Turkish subjects when studying sella turcica morphology.

AUTHORS NOTE

The manuscript was presented as part at a meeting of 13th International Symposium of Turkish Orthodontic Society 3-5 November 2013.

REFERENCES

1. 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: 457-63.
2. Elster AD. Imaging of the sella: anatomy and pathology. *Seminars in Ultrasound, CT and MRI* 1993; 14: 182-94.
3. Elster AD. Modern imaging of the pituitary. *Radiology* 1993; 187: 1-14.
4. Pisaneschi M, Kapoor G. Imaging the sella and parasellar region. *Neuroimaging Clinics of North America* 2005; 15: 203-19.
5. Weisberg LA, Zimmerman EA, Frantz AG. Diagnosis and evaluation of patients with an enlarged sella turcica. *The American journal of medicine* 1976; 61: 590-6.
6. Friedland B, Meazzini MC. Incidental finding of an enlarged sella turcica on a lateral cephalogram. *Am J Orthod Dentofacial Orthop* 1996; 11: 508-12.
7. Alkofide E. Pituitary adenoma: a cephalometric finding. *Am J Orthod Dentofacial Orthop* 2001; 120: 559-62.
8. Kjær I, Keeling JW, Fischer Hansen B, Becktor KB. Midline skeletodental morphology in holoprosencephaly. *The Cleft palate-craniofacial journal* 2002; 39: 357-63.
9. Kjær I, Hjalgrim H, Russell BG. Cranial and hand skeleton in fragile X syndrome. *American journal of medical genetics* 2001; 100: 156-61.
10. Russell BG, Kjær I. Postnatal structure of the sella turcica in Down syndrome. *American journal of medical genetics* 1999; 87: 183-8.
11. Silverman FN. Roentgen standards for size of the pituitary fossa from infancy through adolescence. *American Journal of Roentgenology* 1957; 78: 451-60.
12. Kisling E. Cranial morphology in Down's syndrome. A comparative roentgencephalometric study in adult males Thesis, Munksgaard, Copenhagen, 1966.
13. Gordon MB, Bell AL. A roentgenographic study of the sella turcica in normal children. *Endocrinology* 1922; 22: 54-9.
14. Camp JD. Normal and pathological anatomy of the sella turcica as revealed by roentgenograms. *Am J Roentgenol* 1924; 12: 143-56.
15. Teal J. Radiology of the adult sella turcica. *Bulletin of the Los Angeles neurological societies* 1976; 42: 111-74.
16. Kantor ML, Norton LA. Normal radiographic anatomy and common anomalies seen in cephalometric films. *Am J Orthod Dentofacial Orthop* 1987; 91: 414-26.
17. 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: 572-7.
18. 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.
19. Kjær I, Wagner A, Madsen P, Blichfeldt S, Rasmussen K, Russell B. The sella turcica in children with lumbosacral myelomeningocele. *Eur J Orthod* 1998; 20: 443-8.
20. Becktor JP, Einersen S, Kjær I. A sella turcica bridge in subjects with severe craniofacial deviations. *Eur J Orthod* 2000; 22: 69-74.
21. Kjær I, Hansen N, Becktor K, Birkebaek N, Balslev T. Craniofacial morphology, dentition, and skeletal maturity in four siblings with Seckel syndrome. *The Cleft palate-craniofacial journal* 2001; 38: 645-51.
22. Israel H. Continuing growth in sella turcica with age. *American Journal of Roentgenology* 1970; 108: 516-27.
23. Preston CB. Pituitary fossa size and facial type. *Am J Orthod* 1979; 75: 259-63.