The prevalence of Sella Turcica Bridging in Different skeletal Classes

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ABSTRACT

Background: Sella Turcica is an important anatomical structure for cephalometric assessment because within its center lies sella point which helps in evaluation of craniofacial morphology.The purpose of this study was to evaluate the prevalence of a SellaTurcicabridge and linear measurements of sella in subjects with different skeletal Classes.

Materials and method: Sella Turcica bridging and size were evaluated forfive hundred pre-treatment digital lateral cephalometric radiographs of Iraqi male (223) and female (277) patients with age range10-39 years, they were collected and classified into three groups according to skeletal classes.

RESULTSSella turcica bridging was found in the three groups, the overall rate of Sella Turcica bridging was higher in skeletal class III group (42.57%) and in female (21.2%) but the difference was non-significant. there was a significant difference in sella bridging between the three age groups (it was higher in the younger age group).A non- significant- difference in sella size between genders, age groups and skeletal classes.

Conclusions: the prevalence of sella turcica bridging is greater in patients with a skeletal Class III relationship, females and young age group.Skeletal class, age and gender had a non- significant difference in Sella Turcica linear measurements. Bridging of sella, in the absence of clinical signs or symptoms, is considered a normal variant of the sella turcica, although many pathological processes can be associated with this calcification.

Key words: sella turcica; sella bridging; skeletal class.

INTRODUCTION

Lateral cephalometric radiograph displays numerous cranial, facial and oral anatomic structures imaged from lateral aspect. Cephalometric radiography is a helpful aid in diagnosis, treatment planning and predicting treatment outcome in current orthodontic practice [1, 2]. The morphology of Sella Turcica is, in this connection, of importance for the cephalometric positioning of sella point [S], the central reference point used in evaluation of the cranial morphology and inter-relationship between jaws. [3]

Sella Turcica is situated on the intracranial surface of the body of the sphenoid bone. The anterior border of sella turcica is represented by the tuberculum sella and the posterior border by the dorsum sella. The pituitary gland is surrounded by sella turcica, whereas two anterior and two posterior clinoid processes project over the pituitary fossa. The anterior clinoid processes are formed by the medial and anterior prolongations of the lesser wing of the sphenoid bone, and the posterior clinoid processes by the endings of the dorsum sella. During embryological development, Sella turcica area is a key point for the migration of the neural crest cells to the frontonasal and maxillary developmental fields. [4, 5]

Morphologically, three basic types (oval, round, and flat) have been classified, the oval and round types being the most common, deviation from normal size and shape of sella turcica can be an indication of a pathological condition of the gland[5].A larger size may be indication of pituitary tumor over producing hormones such as ACTH, Prolactin and Growth hormones, thyroid stimulating hormone and vasopressin leading to Cushing's syndrome, amenorrhea and acromegaly. A small size can lead to decreased pituitary function causing symptoms such as short stature, retarded skeletal maturation and growth. Small Sella Turcica are notable in humans who either have an absent or a partial formed diaphragm sellae.[2] Calcification of diaphragm sellae, which radiologically has been described as ' roofing ' or ' bridging ' of the sella, in the absence of clinical signs or symptoms, is considered a normal variant of the sella turcica[6], although many pathological processes can be associated with this calcification.

As far as aetiology is concerned, it has been suggested that an ICL (interclinoid ligament) is laid down in cartilage at an early stage of development and then ossifies in very early childhood. This ossification can be due to the complex embryology of the sphenoid

bone[3]. According to this theory; a sella turcica bridge should be considered a developmental anomaly.

Additionally, bridging of Sella Turcica has been reported to occur in distinctive syndromes or skeletal and dental malformations[5,7-10].In a 'normal' population, the prevalence of a Sella Turcica bridge has been reported with a frequency of 1.75 to 6 per cent in anatomical and radiographic studies[5,11, 12].

SUBJECTS AND METHODS

Total of 500 digital cephalometric images of Iraqi patients attending the Diagnosis and Orthodontic Departments, College of Dentistry/Baghdad University were collected and examined (only the radiographs of good quality were included in the study).

Analysis of the craniofacial complex*:* By using Auto CAD 2010 computer program, seven points and six lines were determined (fig. 1). The images were divided in to three groups according to skeletal classes. Classification of skeletal type into Class I(131), Class II(174), or Class III(195) was based on the ANB angle (SNA and SNB). The ANB angle indicates the magnitude of the skeletal jaw discrepancy, regardless of which jaw is at fault. Skeletal base Class was categorized as follows: angles 2-4 degrees Class I skeletal base; angles more than 4 degrees Class II, and angles less than 2 degrees Class III.The images were divided in to three groups according to age (10-19), (20-29) and (30- 39) years.

Analysis of Sella Turcica*:* linear measurements of Sella Turcica were evaluated according to Silverman [13]; all reference lines used are situated in the midsaggital plane (fig. 1).

Sella Turcica length: It was measured as the distance from the dorsum sellae (DS) to the tuberculum-sellae (TS).

Sella Turcica depth: was measured as a perpendicular line from the line above to the deepest point on the floor of the fossa (FS).

Sella Turcica diameter: was measured from the tuberculum sellae (TS) to the remote point on the posterior inner wall of the fossa.

The bridging of Sella Turcica was evaluated by using the method of Leonardi *et al*.[9], A standardized scoring scale was established which consisted of comparing measurements of Sella Turcica length and diameter, if the length of Sella Turcica was greater than or equal to three-fourths of the diameter, the Sella was scored as Class I (no calcification); if less than three-quarters (ICL partially calcified) as Class II; and Class III for a radiographically visible diaphragm Sella (ICL completely calcified), as shown in fig.2 a,b,c.

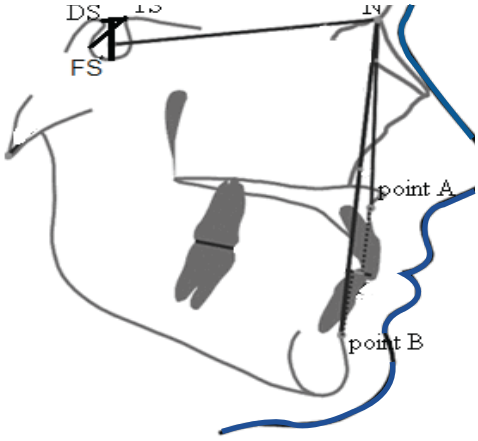

Figure 1: Reference points and plane landmark

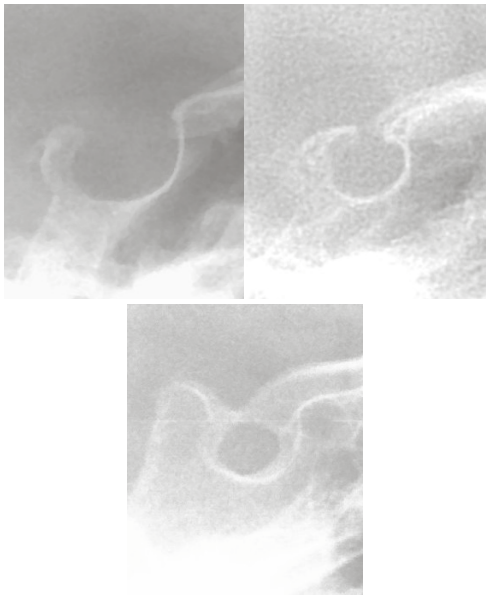

Figure2: Radiographical appearance of Sella Turcica Bridging
A: no bridging B: partial bridging C: complete bridging

Statistical analyses were computer assisted using SPSS version 13 (Statistical Package for Social Sciences).The frequency distribution and percentage of bridging in each skeletal class were measured and the difference in median of Sella Turcica bridging between the three age groups and skeletal classses were assessed by non-parametric Kruskal-WallisTest, while between bridging and gender by Mann-Whitney test. Dunn's Multiple Comparison test was performed as post test if the P-value was significant. A student's t-test was used for assessment of male –female difference in linear measurements, while ANOVA used for assessment of difference in linear measurements between age groups and skeletal classes with (LSD) as post test if the result is significant.

RESULTS

Sella Turcica bridging was found in the three skeletal groups, inskeletal Class I group [33.58% demonstrate class II (partial bridging) of sella turcica and 4.58% demonstrate class III (complete bridging)], while in skeletal class II group [29.31% demonstrate class II (partial bridging) and 6.32% demonstrate class III (complete bridging)], while in skeletal class III group [33.84% demonstrate class II (partial bridging) and 8.71% demonstrate class III (complete bridging)], allthe details are demonstrated in table 1.The overall rate of sella turcica bridging was higher in skeletal class III group (42.57%) as shown in figure 3 and the Kruskall –Wallis test show a non-significant difference between the three groups (P-value = 0.7).

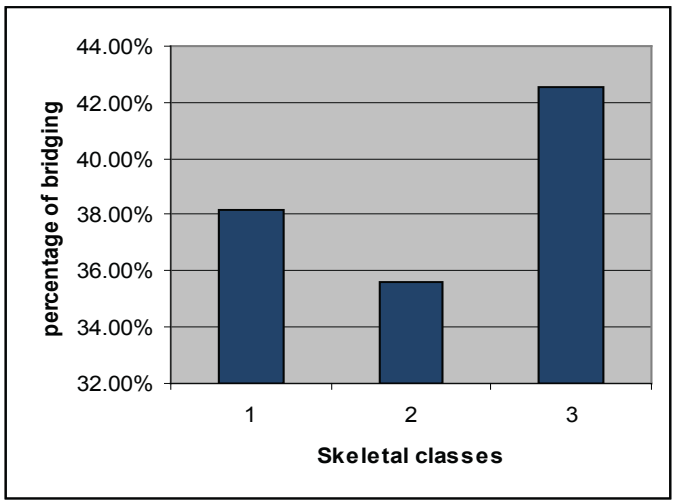

Figure 3: Bar chart demonstrating the over all percentage of bridging in the three skeletal classes.

Sella turcica bridging was higher in female (21.2 %) than male (17.8 %) but the difference was non-significant, while there was a significant difference in sella bridging between three age groups (it was higher in the youngest age group 39.2%) as shown in tables 1,2.

Regarding the size of sella turcica, all linear measurements of Sella Turcica were within standard range.There was a non-significant difference in linear measurements of sella between skeletal classes, also a non-significant difference between male and female in spite of that male had higher measurements. Size of sella increase with age especially in the first and second age group but the difference was non-significant between the three age groups (the details of sella turcica linear measurements were found in tables 3, 4, 5).

DISCUSSION

In this retrospective study, the bridging and size of Sella Turcica was measured on pre-treatment standardized digital lateral cephalometric radiographs.

The presence of Sella Turcica bridging in normal individual is not uncommon and is seen in 5.5% -22 % of the subjects[14], however there is increase in occurrence in patients with craniofacial deviation. In anatomical studies with direct inspection of autopsy tissue, the prevalence of Sella Turcica bridge was found to be 1.75 to 6% without a distinctive craniofacial anomaly[11, 12].The differences between direct anatomical studies and data from lateral cephalometric radiographs have been attributed to superimposition of the overlapping clinoid processes of the sella turcica. Therefore, only three-dimensional imaging such as computed tomography or digital volume tomography could give more precise information about the sella area. However, routine use of these imaging techniques in orthodontic patients is not indicated due to the higher exposure to radiation, particularly with computed tomography.

There was two studies that analyzed the prevalence of Sella Turcica bridge in relation to skeletal Class, the first one was conducted in Germany, by Meyer-Marcotty *et al*. [5], he examined 400 pre-treatment lateral cephalograms of adult patients (over 17 years of age) with a skeletal Class (I and III) he found that Skeletal Class III patients presented a significantly higher rate of sella bridging comparison with skeletal Class I patients, and a non- significant difference between genders were detected for linear measurements of sella. These results are consistent with the results of the current study.

The second study was done by Shah *et al*.[2], he examined 180 lateral cephalometric radiographs; he found that 66.7 % of the subjects presented with normal morphology and the others had different morphological shapes but the bridging was not found in any subject. There is an agreement with Shah *et al*. in the percentage of normal morphology but not in the percentage of bridging and this may be due to different measuring technique of bridging, because he depends on visual evaluation of sella bridging and not on mathematical measurement. Also he reported a non-significant difference in linear measurements of sella between genders and skeletal classes, these results are consistent with the results of the current study.

There is an agreement with our previous study which conducted on group of patients with malposed maxillary canine[10], the result showed a significant difference in sella bridging between age groups (the younger age group had high bridging magnitude).

Axelsson *et al*. [14]measured Sella Turcica size and morphology in Norwegian subjects (6-21 years),

he found that sella size increase with age with no differences between males and females, and female subjects had slightly more morphological aberration of Sella Turcica. These results are consistent with the results of the current study.

Few studies have compared the skeletal type of individuals with their Sella Turcica size to determine if a relationship exists. Alkofide[15] conclude that sella size increase with age and the diameter was higher in skeletal class III subjects with no differences in linear measurements between males and females. These results are consistent with the results of the current study.

In this study non-significant differences in Sella Turcica length, depth and diameter were detected between genders and skeletal classes, these results are agreed with those reported by yassir *et al*. [16], Obayis and Al-Bustani[17], these studies conducted on Iraqi patients and measured the dimensions and morphology of Sella Turcica, but both of them depend on visual evaluation of sella to determine their morphology so there is in conformity with their result dealing with bridging magnitude.

Table 1: The frequency and percentage of Sella bridging in three skeletal classes and genders

Sella Bridging	Skeletal Class						Gender				Total	
	Cl I		Cl II		Cl III		Male		Female			
	N	%	N	%	N	%	N	%	N	%	N	%
Cl I	81	6 1.84	112	64.36	112	57.43	134	26.8	171	34.2	305	61
Cl II	44	33.58	51	29.32	66	33.84	73	14.6	88	17.6	161	32.2
Cl III	6	4.58	11	6.32	17	8.73	16	3.2	18	3.6	34	6.8
Total	131	26.2	174	34.8	195	39	223	44.6	277	55.4	500	100
P -value	0.7 (n.s)						0.3 (n.s)					

*** n.s (non-significant difference) P- value > 0.05**

Table 2: The frequency and percentage of Sella bridging in three age groups

Sella Bridging	10-19 year		20-29 year		30-39 year		P-value
	N	%	N	%	N	%	
Cl I	109	21.8	57	11.4	14	2.8	0.04 (S)
Cl II	149	29.8	65	13	10	2	
Cl III	47	9.4	39	7.8	10	2	
Total	305	61	161	32.2	34	6.8	

Table 3: Sella turcica linear measurements (mm) in different skeletal classes

Size	Skeletal class I			Skeletal class II			Skeletal class III			P-value
	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.97	8.93	1.74	5.24-13.36	8.9	1.82	5.03-14.01	8.81	1.85	0.8 (n.s)
Depth (mm)	4.64-10.85	7.52	0.92	4.73-10.63	7.6	1.02	4.51-9.82	7.45	1.02	0.3 (n.s)
Diameter (mm)	8.81-14.81	11.5	1.21	8.93-15.15	11.49	1.24	7.65-15.55	11.66	1.35	0.3 (n.s)

Table 4: Sella turcica linear measurements (mm) for males and females

Size	Male			Female			P-value
	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.42	8.95	1.82	5.02-14.01	8.81	1.8	0.3 (n.s)
Depth (mm)	4.73-10.08	7.51	0.95	4.51-10.85	7.35	1.03	0.8 (n.s)
Diameter (mm)	8.85-15.55	11.64	1.3	7.65-15.15	11.5	1.26	0.2 (n.s)

Table 5: Sella turcica linear measurements (mm) by age group

Size	10-19 years			20-29 years			30-39 years			P-value
	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.97	8.81	1.93	5.02-14.01	9.03	1.75	4.13-12.97	8.56	1.7	0.2 (n.s)
Depth (mm)	4.64-9.91	7.43	1.05	4.51-10.85	7.6	1.02	4.51-9.55	7.84	0.82	0.2 (n.s)
Diameter (mm)	7.65-15.55	11.53	1.46	8.93-15.15	11.62	1.2	7.65-14.85	11.45	1.09	0.7 (n.s)

REFERENCES

1. Weems RA. Radiographic Cephalometry Technique. In: Jacobson A, L.Jacobson R, editors. Radiographic Cephalometry from basics to 3-D Imaging. Chicago: Quintessence books; 2006. p. 33-43.
2. Shah AM, Bashir U, Ilyas T. The shape and Size of The SellaTurcica in Skeletal Class I, II & III Patients Presenting at Islamic International Dental Hospital, Islamabad. Pakistan Oral & Dental J 2011; 31(1): 104-110.
3. Becktor JP, Einersen S, Kjær I. SellaTurcica Bridge in subjects with severe craniofacial deviations. Europ J of Orthod 2000; 22: 69 – 74.
4. Kjær I, Keeling J W, Fischer-Hansen The prenatal human cranium—normal and pathologic development. Munksgard, Copenhagen B 1999.
5. Meyer-Marcotty P, Reuther T, Stellzig-Eisenhauer A. Bridging of the SellaTurcica in Skeletal Class III Subjects. Europ J Orthod 2010; 32:148-153.
6. Kantor ML, Norton LA. Normal radiographic anatomy and common anomalies seen in cephalometric films. Am J Orthod Dentofac Orthop 1987; 91(5): 414-26.
7. Childers NK, Wright JT. Dental and craniofacial anomalies of Axenfeld- Rieger syndrome. J Oral Pathology 1986; 15: 534–9.
8. Koshino T, Konno T, Ohzeki T. Bone and joint manifestations of Rieger's syndrome: a report of a family. J Pediatric Orthopedics 1989; 9: 224–230.
9. Leonardi R, Barbato E, Vichi M, Caltabiano M.A sellaturcica bridge in subjects with dental anomalies. Europ J Orthod 2006; 28: 580–585.
10. Najim AA, Al-Nakib L. A cephalometric study of sella turcica size and morphology among young Iraqi normal population in comparison to patients with maxillary malpose canine. J Bagh Coll Dent 2011; 23(4):53-58.
11. Busch W. Die Morphologie der Sellaturcica und ihreBeziehungzurHypophyse. Virchows Archiv 1951; 320: 437–58.
12. Platzer W. ZurAnatomie der Sellabrücke und ihrerBeziehungzur A. carotisinterna. Fortschritte auf demGebiet der Roentgenstrahlen und der Nuklearmedizin 1957; 87: 613–616.
13. Silverman FN. Roentgen standards for size of the pituitary fossa from infancy through adolescence. Am J Roentgenol 1957; 78(3): 45-60.
14. Axelsson S, Storhaug K, Kjaer I. Post-natal size and morphologyof the sellaturcica. Longitudinal cephalometric standardsfor Norwegians between 6 and 21 years of age. Eur J Orthod 2004; 26:597-604
15. Alkofide EA. The shape and size of the sellaturcica in skeletal Class I, Class II, and Class III Saudi subjects. Eur J Orthod 2007; 29(5): 457-63.
16. Yassir YA, Nahidh M, Yousif HA. Size and Morphology of SellaTurcica in Iraqi Adults. Al-Mustansiria Dent J 2010; 7(1):23-30.
17. Obayis KA., Al-Bustani A. Clinical significance of sellaturcica morphologies and dimensions in relation to different skeletal patterns and skeletal maturity assessment. J Bagh Coll Dent 2012; 24(2):120-126.