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CORRELATION OF LINEAR DIMENSIONS OF SELLA TURCICA WITH ANTEROPOSTERIOR SKELETAL JAW RELATIONSHIP OF EGYPTIAN SUBJECTS USING CBCT

Mohamed Adel Nadim*

ABSTRACT

The aim of this retrospective study was to find whether there is a correlation between the linear dimensions of the sella turcica and different anteroposterior skeletal growth patterns in an Egyptian population using CBCT. CBCT radiographs of 129 adult patients (60 males, 69 females) were retrieved from the archive of the radiology department of the Faculty of Dentistry, Suez Canal University. They were divided into three groups according to sagittal growth pattern and the sella turcica length, depth and diameter were measured for each case. No statistically significant differences were found between all sella turcica measurements and the anteroposterior jaw relationship. The p-values were 0.087, 0.007 and 0.998 for the diameter, depth and length respectively.

INTRODUCTION

Several reference points in the craniofacial region are used for the tracing of lateral cephalograms during diagnosis of facial skeletal type and assessment of orthodontics treatments. Among those landmarks the sella point is of special significance due to its role as the reference point in the assessment of cranial morphology and intermaxillary relations. This point is located in the center of the sella turcica, with the turcica housing the pituitary gland in the cranial base.

Pathologies or abnormalities of the gland result in changes in the shape and size of the sella turcica and are manifested as disturbances in the regulation of secretion of glandular hormones such as TSH, prolactin growth hormones and follicular stimulating hormone. (1,2)

Such disturbances can in return lead to growth abnormalities such as acromegaly, or gigantism, intrasellar pituitary primary tumors or syndromes like Williams or Sheehan's syndrome. (3,4)

Previous studies conducted on the shape of sella turcica have concluded that its morphological appearance is established in the early embryonic life. Kjaer et al. studied the profile radiographs of 16 children born with myelomeningocele and found an altered shape of sella present during foetl life. (5)

* Assistant Professor of Orthodontics, Faculty of Dentistry, Suez Canal University

Furthermore, Russell and Kjaer found an evident change of sella turcica shape prenatally and postnatally in children with fragile X and Down syndrome. [6]

In the field of orthodontics it is sometimes insufficient to rely solely on the results of lateral cephalograms to discriminate facial skeletal types. In such cases knowledge about the relationship between shape and size of sella turcica and the type of facial skeletal class can help the orthodontist reach a definitive decision for treatment planning. [7]

Several studies have been conducted to correlate the size and shape of the sella turcica and the anteroposterior relationship of the jaws in different populations using conventional lateral cephalograms. [8-10]

From the abovementioned review it could be seen that the previous studies were conducted using lateral cephalograms and none to our knowledge was performed on an Egyptian sample.

The aim of the present study is to find out whether there is a correlation between the size and shape of sella turcica and the sagittal relationship of the jaws in an Egyptian population using CBCT.

MATERIALS AND METHODS

The present retrospective study was conducted on the CBCT radiographs of 129 patients ranging in age between 20 and 40 years (60 males and 69 females). Radiographs of adults only were selected for the study because the morphology of sella turcica does not change significantly after the age of 12 years. [11] The radiographs were taken from the archives of the Oral Radiology Department Faculty of Dentistry, Suez Canal University.

The selection criteria of the CBCT images were as follows:

1. High quality full skull CBCT images where the sella turcica appeared with maximum clarity.
2. The CBCT images were of subjects free from any craniofacial abnormalities.
3. No apparent pathology of the maxillofacial region.
4. No apparent facial asymmetry.
5. No significant anatomical variation in the sella turcica and sphenoidal regions.

The CBCT images were performed using SCANORA 3DX scanner. (Scanora 3DX, Soredex, Finland). The field of view was fixed at 240x165mm for all images using standard resolution mode. The operating parameters were 90KVp, 10mA and the scan time was about 6 seconds. The voxel size was 0.5 mm using Flat panel a-Si detector. The acquired data was transferred into DICOM format, then exported into On Demand 3D application software (On Demand Cybermed. Co., Seoul, Korea) for image analysis and measurements. Using Dental 3D and dynamic light box display application, the linear measurements of length, depth, and diameter of the sella turcica were done using the method described by Silverman [12].

The axial view at the level of the anterior nasal spine was used for all measurements taken from CBCT images. Subsequently, 1-mm sagittal slices, were made distal to (right side) of the midsagittal plane, for the measurement of the length, depth and diameter of the sella turcica. (Fig.1and 2).

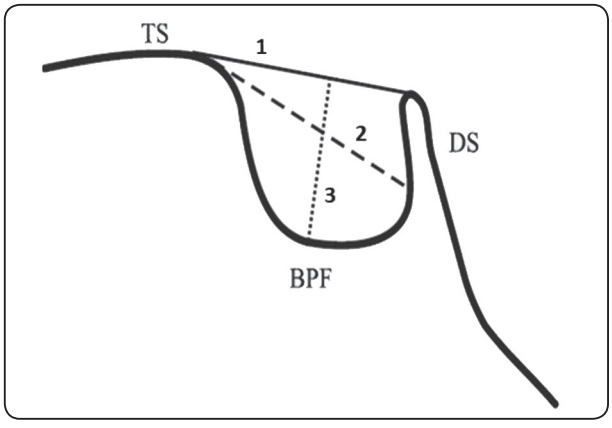

Fig. (1) The sella turcica length (1), diameter (2) and depth (3); TS — tuberculum sella; DS — dorsum sella; BPF — base of pituitary fossa [18, 36].

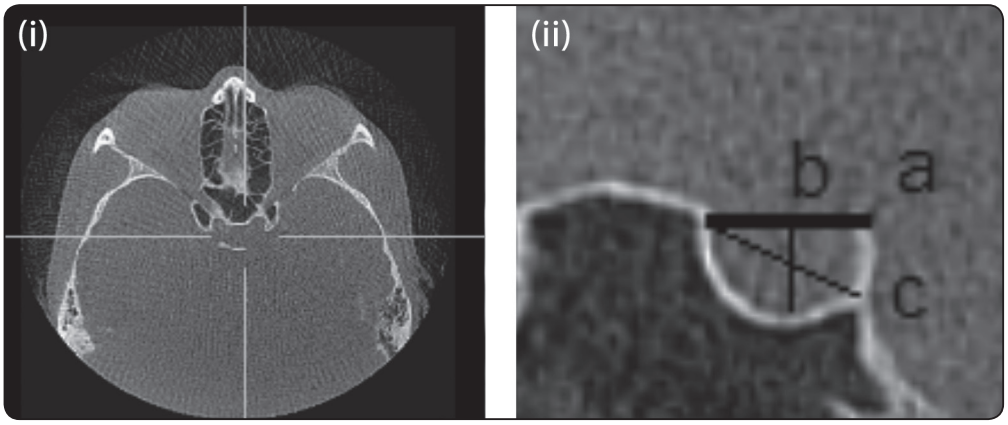

Fig. (2) i) The blue line shows the midsagittal slice selected as a reference view for the measurement of length, diameter, and depth. ii) The reference lines used for measuring the sella turcica size on the midsagittal slice: a) bold line, length of sella; b) line, prebendicular to length depth of sella; c) diameter of sella.

The sella turcica length is defined as the distance between the tip of tuberculum sellae and dorsum sellae.

The depth is the deepest point of the floor of sella turcica, and the diameter is the furthest point on the posteroinferior aspect of the pituitary fossa to the most superior point on the tuberculum sella.

Radiologic evaluations were performed by an experienced dento-maxillofacial radiologist. The intra-observer agreement was performed by reassessing the greater part of the images twice, with a 4-week interval between both viewings.

Grouping of CBCT images:

From the 3D reformatted CBCT images volumes were divided into three groups based on the ANB angle, the images were divided according to the sagittal skeletal dentofacial skeletal pattern: Class I (ANB; 2–4°), Class II (ANB; > 4°), and class III (ANB; < 2°).

Statistical Analysis

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Data showed normal (parametric) distribution. Data were presented as mean, standard deviation (SD) and 95% Confidence Interval (95% CI) values. One-way ANOVA was used to compare between the six groups. Bonferroni's post-hoc test was used for pair-wise comparisons. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS® Statistics Version 20 for Windows.

RESULTS

The mean and standard deviation and the results of one-way ANOVA test for comparisons between Sella Turcica measurements in the three groups are shown in table (1). No statistically significant differences were found between all sella turcica measurements and the anteroposterior jaw relationship. The p-values were 0.087, 0.007 and 0.998 for the diameter, depth and length respectively.

TABLE (1): Descriptive statistics and results of one-way ANOVA test for comparisons between Sella Turcica measurements in the three groups

	Diameter	Depth	Length
Class I (n = 33)			
Mean (SD)	11.39 (0.99)	6.99 (1.4)	10.09 (1.43)
95% CI	11.04-11.74	6.5-7.49	9.58-10.6
Class II (n = 71)			
Mean (SD)	11.79 (1.32)	7.25 (1.51)	10.1 (1.7)
95% CI	11.48-12.11	6.89-7.61	9.69-10.5
Class III (n = 25)			
Mean (SD)	11.29 (0.69)	7.29 (1.08)	10.07 (1.88)
95% CI	11-11.58	6.84-7.73	9.29-10.85
P-value	0.087	0.640	0.998
Effect size (Eta squared)	0.038	0.007	0.00004

**: Significant at P ≤ 0.05*

DISCUSSION

The current retrospective study was conducted to find out if there is a correlation between the linear measurements of sella turcica and the different anteroposterior skeletal jaw relationships using CBCT. One hundred twenty-nine CBCT radiographs of adults were examined. There was no sex predilection in the study since multiple previous studies found no differences between males and females in terms of sella turcica size. [12,13]

The measurements of the sella turcica are of importance since changes in its size and shape could be indicative of pituitary gland disease. The normal dimensions of length, diameter and depth of sella turcica range from 4 to 16 mm. [13-15]

In the current study the mean values for the sella measurements were consistent with those reported in previous studies. The reported dimensions in the present study were 11.39±0.99mm for the diameter, 6.99±1.4mm for the depth and 10.09±1.43mm for the length. These findings are in accordance with the work of Tetradis and Kantor [16], who reported a mean sella turcica length and depth of 10.9±1.8mm and 7.6±1.7mm respectively. Furthermore, Canigur Bavbek and Dincer [17] found the normal length and depth values to be 10.9±1.73mm and 8.29±1.66mm respectively. As regards the diameter of the sella turcica the findings of the current study are in accordance with those of Soakar and Nawale (18) who reported a mean diameter of 11.18±1.34mm.

Only a few studies were conducted on the effect of anteroposterior jaw relationship on the sella turcica size. Those studies mainly used lateral cephalograms for their measurements. To our knowledge none was conducted using CBCT. The inherent drawback of superimposition found in lateral cephalograms is nowadays overcome when using 3D CBCTs for diagnostic purposes in the field of orthodontics.

The results of the present study revealed no significant differences in the sella dimensions between the three groups. Preston [19] measured the mean sella size of the pituitary fossa and found no sta-

tistically significant correlation to the facial type. Furthermore, Magat and Ozcan Sener [20] studied the lateral cephalograms of a Turkish population of different ages and genders and correlated the skeletal facial type to the sella linear measurements and also found no significant correlation between them.

On the other hand, Alkofide [13] concluded that individuals with skeletal Class III jaw relationship had a larger sella diameter compared to Class I and Class II individuals. Similar results were reported by Valizadeh et al [7] who found that Class III subjects had greater length of the sella when compared to Class I and Class II subjects. In addition, they reported similar sella turcica depth and diameter in subjects with different skeletal patterns.

Those differences in findings could be attributed to the use of lateral cephalograms in the abovementioned studies compared to the use of CBCT in the present one resulting in different magnifications. The use of three-dimensional imaging for studying pituitary gland size was recommended by Magat and Ozcan Sener [20]. Different ethnic groups, age groups and gender differences could also have attributed to the variation in results between the present study and the studies of Alkofide [13] and Valizadeh et al [7].

CONCLUSIONS

1. CBCT could be used to study the dimensions of the sella turcica with high accuracy.
2. There were no differences in sella turcica linear measurements between different anteroposterior skeletal patterns.
3. The linear dimensions obtained from the present study could be used to estimate the size of the pituitary gland, hence expect the presence of pathology in cases of abnormally large sella turcica.
4. The results of the present study of sella turcica size could be used as a reference for Egyptian subjects when examining sella turcica dimensions.

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