ORIGINAL ARTICLE

THE FREQUENCY OF SELLA TURCICA BRIDGING IN ORTHODONTIC PATIENTS AND ITS ASSOCIATION WITH SAGITTAL AND VERTICAL MALOCCLUSION GROUPS

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ABSTRACT

Sella Turcica is an important structure of the middle cranial fossa and can easily be seen on lateral cephalometric radiographic. In orthodontics, sella point is commonly used to measure the positions of maxilla and mandible in relation to the cranium. The aim of this study was to determine the frequency of sella turcica bridging in orthodontic patients and find its association with different sagittal and vertical malocclusion groups. A total of 316 patients (98 males, 218 females) who belonged to different malocclusion groups were included in this study. Lateral cephalograms of these patients were analyzed for the presence of sella turcica bridging. Out of 316 subjects, 5 patients (1.6%) were found to have complete sella turcica bridging. Partial bridging was found in 142 cases (44.9 %) while the remaining 169 patients had no bridging. A comparison of sella turcica bridging among the sagittal and vertical malocclusion groups was not significant. No significant difference was found in frequency of sella bridging between males and females. The linear dimensions of sella turcica were also compared among the groups. A statistically significant difference was found in the antero-posterior diameter of the sella turcica among the three sagittal. However, the difference in vertical groups was not significant. Class II malocclusion had the smallest linear dimensions than other groups while in vertical group, hypodivergent malocclusion had the smallest dimensions as compared to other groups. No significant association was found between sella turcica bridging and vertical and sagittal malocclusion groups.

Key Words: *Sella turcica bridging, malocclusion groups, orthodontic patients.*

INTRODUCTION

Sella turcica is an important structure of the middle cranial fossa and can easily be seen on radiographic analysis of the craniofacial complex. In orthodontics, sella point which is located at the center of sella turcica is one of the most commonly used landmarks in cephalometrics. Such landmarks located within the cranial base region are used to measure the positions of maxilla and mandible in relation to the cranium.[1]

The sella turcica in the sphenoid bone consists of a central hypophysial fossa and two pair of clinoid processes (anterior and posterior). Those processes are connected by a horizontal fold of dura mater described as interclinoid dural fold or interclinoid ligament. On a lateral cephalometric radiograph the image of sella turcica is U shaped. A deviation from normal size and shape of sella turcica can be an indication of some pathological condition of the pituitary gland.[2]

The horizontal interclinoid dural fold sometimes calcify partially or completely in some peoples, which can be seen and diagnosed on lateral cephalometric radiograph.[3] The sella turcica bridge (STB) is the true bony union of the anterior and posterior clinoid processes while the clinoid enlargement (CLEN), is the overlapping of the anterior and posterior clinoid processes[4] and not necessarily real bony fusion.[5] Bridging of the sella turcica is considered as an anatomical abnormality and has been reported to occur in skeletal and dental malformations and in several syndromes.[6] Sella turcica bridging, has been shown to occur in up to 1.1-13 percent of the general population[4] with an increased prevalence in those with severe craniofacial disproportion.[5]

The aim of this study was to determine the frequency of sella turcica bridging in our orthodontic patients

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and find its any possible association with sagittal and vertical skeletal patterns.

METHODOLOGY

This cross sectional study was conducted at the department of orthodontics at Sardar Begum Dental College, Peshawar. A total of 316 patients (98 males, 218 females) were included in this study. The data were collected from pre-treatment orthodontic records which included lateral cephalometric radiographs and casts.

Our inclusion criteria was:

- All orthodontic patients with availability of good quality records.

Exclusion criteria was:

- Cleft lip and palate or any craniofacial anomaly
- Trauma to the face/ teeth
- Any systemic illness/malignancy requiring radiation of craniofacial region

Pretreatment cephalometric radiographs of all patients were traced manually on acetate sheets with a 0.5-mm lead pencil in a dark room with conventional methods by the operator. All anatomical landmarks and planes were identified and traced as per standard protocol. Sella turcica was also drawn as a structure from the tip of the dorsum sella to that of the tuberculum sellae as seen on the radiograph. Cephalometric analysis was performed for determination of vertical and sagittal skeletal patterns. Subject were allocated to different sagittal malocclusion groups on the basis of ANB angle and Witts analysis as per standard protocol used in orthodontics. For vertical pattern, the patients were allocated into any of the three groups on the basis of SN-MP angle and FMPA.

The following variables were recoded for each patient: age, sex, sagittal and vertical skeletal patterns, sella turcica dimensions (length, depth and diameter), presence or absence of bridge and classification of type of sella turcica bridge if present. The diagnosis of a possible bridge was made by the principal investigator on the lateral cephalograms with the clearest reproduction of the relevant area.

The following dimensions of sella turcica were noted as shown in fig 1:

Length (L): Distance from the tip of the dorsum sellae to that of the tuberculum sellae.

Depth (D): Distance from the above line to the deepest point on the sella floor.

Antero-posterior Diameter (APD): Distance from the tip of the tuberculum sellae to the farthest Point on the inner posterior wall of the hypophyseal fossa.

To evaluate and quantify the level of bridging, the standard scoring scale developed by Leonardi et al7 was used. On the basis of sella dimensions, the bridging was classified into 3 groups.

Type 1 (No calcification): When the length L is either equal to or greater than three fourths of the antero-posterior diameter (APD).

Type 2 (Partial calcification): When the length is less than three fourths of the APD.

Type 3 (Complete calcification): When only the diaphragm sellae is visible on the radiograph.

All these information were recorded on a data collection from specially designed for this study. For method error, duplicate tracings of 17 randomly selected patients were made at one month interval between the two tracings. All the measurement were retaken by the same examiner. Statistical analysis was carried out using paired sample t-test to find out the difference between the two measurements. The mean differences between the first and second measurements were less than 0.1mm for all three linear dimensions which was not statistically significant. This showed a good intra examiner reliability.

The data were subjected to statistical analysis using SPSS software for Windows (version 19.0; SPSS, Chicago, III). Simple descriptive statistics including frequencies, means, standard deviation, maximum, and minimum were calculated for each variable. Chi Square Analysis was used to compare sella bridging in different sagittal and vertical malocclusion groups and in genders. One-way ANOVA was used for comparison of linear dimensions of sella turcica among different sagittal and vertical groups. Spearman correlation coefficient was used to find out any association between sella turcica bridging and vertical and sagittal skeletal malocclusion groups. P value of 0.05 or less was considered significant.

RESULTS

The chronological age range of the entire sample was 7 to 48 years with a mean age of 17.02 ± 5.10 years. The mean age of the male group was 16.34 years ± 5.07 SD, while that of female was 17.28 years ± 5.19 SD. The distribution of subjects according to sagittal and vertical skeletal malocclusion groups is given in Fig 3 and 4.

Out of 316 subjects, 5 patients (1.6%) had complete sella turcica bridging (type III). Partial bridging (type II) was found in 142 cases (44.9%) while the remaining 169 patients had no bridging. Table 1 shows the frequency of sella turcica bridging in both genders. No significant difference was found in the frequency of sella turcica bridging between the two genders (Table 1).

Table 2 and 3 shows the distribution of sella turcica bridging in different sagittal and vertical malocclusion groups. A comparison of sella bridging among sagittal

TABLE 1: SELLA TURCICA BRIDGING IN BOTH GENDERS IN ENTIRE SAMPLE

	Type 1	Type 2	Type 3	Total	p value
Males	54	43	1	98	
Females	115	99	4	218	0.823
Total	169	142	5	316	

Test of significance: Chi Sqauare Analysis
Level of significance: P ≤ 0.05

TABLE 2: SELLA TURCICA BRIDGING IN SAGITTAL MALOCCLUSION GROUPS

	Type 1	Type 2	Type 3	Total	p-value
Class I	83 (55.7%)	66 (44.3%)	0 (0%)	149 (100%)	
Class II	67 (49.3%)	64 (47.1%)	5 (3.7%)	136 (100%)	0.092
Class III	19 (61.3%)	12 (38.7%)	0 (0%)	31 (100%)	

Test of significance: Chi Sqauare Analysis
Level of significance: P ≤ 0.05

TABLE 3: SELLA TURCICA BRIDGING IN VERTICAL MALOCCLUSION GROUPS

	Type 1	Type 2	Type 3	Total	p-value
Normodivergent	96 (53.9 %)	78 (43.8%)	4 (2.2)	178 (100%)	
Hyperdivergent	50 (52.6%)	44 (46.3%)	1 (1.1%)	95 (100%)	0.830
Hypodivergent	23 (53.5%)	20 (46.5%)	0 (0%)	43 (100%)	

Test of significance: Chi Sqauare Analysis
Level of significance: P ≤ 0.05

TABLE 4: COMPARISON OF SELLA TURCICA DIMENSIONS AMONG THREE SAGITTAL GROUPS

	Class I	Class II	Class III	p value
Length (L)	7.31	6.75	7.48	0.120
Diameter (APD)	9.90	9.21	9.45	0.010*
Depth (D)	7.55	7.21	7.13	0.144

Test of significance: ANOVA
Level of significance: P ≤ 0.05

TABLE 5: COMPARISON OF SELLA TURCICA DIMENSIONS AMONG THREE VERTICAL GROUPS

	Normodivergent	Hyperdivergent	Hypodivergent	p value
Length (L)	7.17	7.14	6.63	0.449
Diameter (APD)	9.71	9.55	8.98	0.084
Depth (D)	7.38	7.45	7.06	0.403

Test of significance: ANOVA
Level of significance: P ≤ 0.05

TABLE 6: CORRELATION ANALYSIS BETWEEN SELLA BRIDGING AND SKELETAL PATTERN

	Sagittal skeletal pattern	Vertical skeletal pattern
Sella turcica bridging	r = 0.091 p = 0.107	r = -0.065 p = 0.248

Test of significance: Spearman's correlation coefficient
Level of significance (2-tailed): P ≤ 0.05

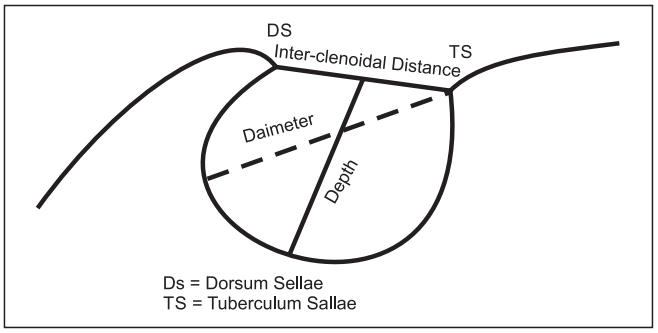

Fig 1: Sella turcica linear dimensions

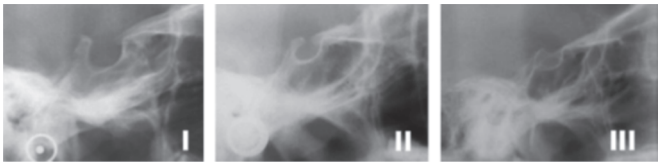

Fig 2: Type of bridging. Type1: no bridging, Type 2: partial bridging, type3: complete bridging

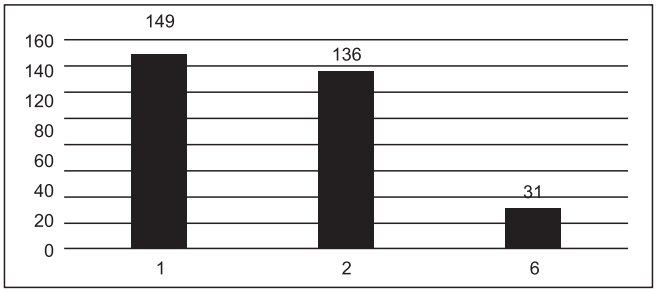

Fig 3: Sagittal Maloclusion Groups Distribution

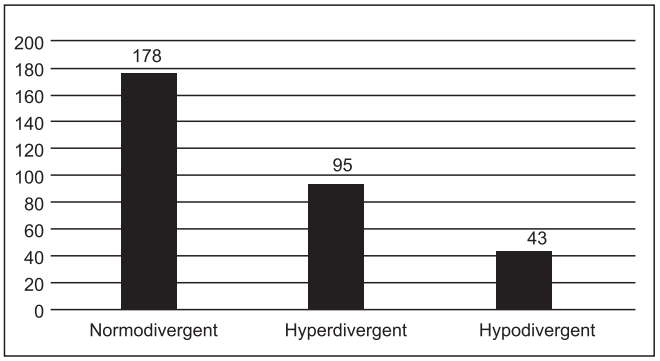

Fig 4: Vertical Maloclusion Group Distribution

malocclusion groups was done to find any difference among these groups. However the result was not statistically significant (Table 2). A similar comparison was done among vertical malocclusion groups. The result showed no statistically significant difference (Table 3).

The linear dimensions of sella turcica (length, antero-posterior diameter and depth) were also compared among sagittal and vertical malocclusion groups using one-way ANOVA. A statistically significant difference (p=0.01) was found in the antero-posterior diameter of the sella turcica among the three sagittal malocclusion groups as shown in Table 4. A comparison of linear dimensions among vertical malocclusion groups was also not statistically significant (Table 5). In sagittal groups, class II malocclusion had the smallest dimensions while in vertical group, hypodivergent malocclusion had the smallest linear dimensions.

A correlation analysis was performed to find any association between the types of sella bridging and types of sagittal and vertical skeletal malocclusion groups. The result was not statistically significant both for vertical and sagittal malocclusion groups as shown in Table 6.

DISCUSSION

Calcification of inter-clinoid ligament of sella turcica is seen in some patients on routine cephalometric evaluation for orthodontic treatment purposes. The extent of calcification varies greatly, resulting in either partial or complete calcification of this ligament and appearance of a bridge on lateral cephalometric radiographs. This bridge formation in the absence of any clinical signs or symptoms is considered a normal variant of sella turcica, although many pathological processes can be associated with this calcification.[7]

This study was conducted to find the frequency of sella turcica bridging in orthodontic patients and in different sagittal and vertical malocclusion groups. The frequency of complete sella turcica bridging was found to be 1.6% while partial bridging was found in 44.9% in the entire sample. In sagittal group, highest rate of sella bridging was found in class II malocclusion. In vertical groups, higher frequency of complete sella bridging was fund in normodivergent group. However the differences among the three vertical and three sagittal group were not statistically significant. A comparison of sella turcica bridging between the two genders showed a higher frequency in females than male subjects. However this difference was not statistically significant.

The frequency of sella turcica bridging in our study was less than those reported by Perez et al[8], Marcotty et al[6], Jones et al[9] and Gulnaz and Evren etc.[10] Perez et al[8] reported complete sella turcica bridging in 4.31% and clinoid enlargement in 13.6% of their sample from Peruvian population. Marcotty et al[6] reported that the frequency of bridging in class III subjects was 16.8%, while in class I subjects this was 9.4%. Jones et al9 found sella bridging in 16.7% cases in the group treated by combined surgical and orthodontic means whereas it was 7.3% in the orthodontic only group. In Gulnaz and Evren[10] study bridging was found in 5% of the Class I and 18% of the Class III patients and this difference was statistically significant. In almost all studies mentioned above, the frequency of sella bridging reported is more than our study. This difference in results from our study can be due to difference in inclusion criteria of the study, difference in population selected, sample size differences or some racial or ethnic background of the study groups.

This study also compared the various linear dimensions of sella turcica in three sagittal and three vertical malocclusion groups. A significant difference was found in antero-posterior diameter of sella turcica

among the three sagittal malocclusion groups (Table 4). Class I subject had the highest value of average antero- posterior diameter than other groups while class II groups was found to have smallest antero-posterior diameter of sella turcica. Interclinoid distance (length) on average was less in Skeletal Class II patients as compared to Skeletal Class I. No statistically significant difference was found in the length and depth of the sella turcica among the three sagittal malocclusion groups. Similarly we also compared linear dimensions among vertical malocclusion groups. The interclinoid distance and antero-posterior diameter of sella turcica was greater in normodivergent that other two groups. While the depth was more in hyper-divergent group than other groups. However these differences were not statistically significant (Table 4 & 5). Asad and Hameed[11] compared the sella dimensions between class I and class II groups. Their result showed a statistically significant difference between the inter-clinoid distances for the two groups. Interclinoid distance on average was less in Skeletal Class II patients when compared with those of Skeletal Class I subjects. This is in accordance to our study. Their study also showed that the incidence of bridging was higher in Skeletal Class II patients which is also in accordance to our study. They also demonstrated statistically significant difference in the mean width of the Sella while mean depth showed no statistically significant difference between the two groups. Alkofide et al[12] reported that there was no significant difference among various linear dimensions among different skeletal groups and between the two genders. He also found that all these dimensions of sella turcica were smaller in class II subjects and larger in class III subjects. This is in accordance to our study result where these dimension were smaller in class II subjects. Bodetti SS[13] et al reported that there was a statistically significant difference in length whereas difference in depth and antero-posterior diameter was not statistically significant. He found that the dimensions of sella were larger in skeletal class III malocclusion group than others which is in contrast to our study results.

In conclusion, our study showed that the frequency of sella turcica bridging in a sample orthodontic patients population of KPK, is less than those reported in other populations. Further studies on a larger scale are needed to corroborate our findings.

CONCLUSION

The following conclusion were drawn:

- The frequency of complete sella turcica bridging in our sample was 1.6%.
- No significant difference was found in the frequency of sella bridging between the two genders
- A comparison of sella turcica bridging among the three sagittal and three vertical malocclusion groups was not significant.
- No significant correlation was found between the sella bridging and type of vertical and sagittal malocclusion groups.
- A comparison of linear dimensions of sella turcica among three sagittal malocclusion group showed a significant difference in Antero-posterior diameter among the three groups.

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1 **Nazir Ahmad:** Principal investigator, study design, manuscript writing, supervised data collection.
2 **Wasif Ali Shah:** Data collection.
3 **Sohrab Shaheed:** Data analysis (SPSS analysis)