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Sella turcica bridging as a potential diagnostic tool for dental anomalies: A retrospective cross-sectional study at university dental hospital

Yazeed Abdulaziz Al-Zahrani[1], Raghu Devanna[2], Yousef Althomali[2], Azzah O. Alhazmi[2], Amith Vasantakumar Holenarasipur[3] and Ahmad Hatem Kariri[1]

Abstract

BACKGROUND: A lateral cephalogram is an essential diagnostic record for an orthodontist. It is used for diagnosis and treatment planning. This can be a prediction tool as well for developing anomalies of the skeletal, dental, and soft tissues of the head and neck. The sella turcica (ST), being a central landmark for cephalometric assessment, has great importance in itself as a diagnostic parameter to predict certain dental problems related to its bridging.

AIM OF THE STUDY: 1. To assess and compare the shape, size, and bridging of ST in subjects of Taif with different skeletal classifications. 2. To find whether there is any association between dental anomalies and sella turcica bridging (STB).

MATERIALS AND METHODS: The study obtained ethical approval from the research ethics committee of Taif University with application no. 44-354 and with no. HAO-02-T-1 dated June 4, 2023. The study involved 87 study samples, divided as follows: a. Group 1: 49 control records. b. Group 2: 38 case records with STB.

RESULTS: The results of our study were promising in relation to STB and the occurrence of dental anomalies in both the case and the control with the frequencies of occurrence being 46.94% and 36.84%, respectively. It was found that the percentage of distribution was more among class I malocclusions and least in class III. It is imperative that impaction (13.8%) is the most associated anomaly, followed by ectopic eruption (11.5%). Supernumerary teeth and gemination were the least associated with STB, and only 1% of the cases showed an association. Statistically significant associations were found for all types of dental anomalies as a result of distribution among cases and controls.

CONCLUSION: Orthodontists commonly employ lateral cephalograms as a regular practice to aid in diagnosis and treatment planning. Furthermore, these cephalograms can serve as predictive tools for dental anomalies. Detecting skeletal abnormalities at an early stage can provide insight into the likelihood of future dental anomalies, enabling clinicians to implement preventive measures accordingly.

Keywords:

Dental anomalies, diagnostic tools, malocclusion, orthodontics, sella turcica

[1]Dental Intern, Faculty of Dentistry, Taif University, [2]Department of Preventive Dentistry, Faculty of Dentistry, Taif University, [3]Division of Community Dentistry, Faculty of Dentistry, Taif University, Taif, Saudi Arabia

Address for correspondence:
Dr. Yazeed Abdulaziz Al-Zahrani, Faculty of Dentistry, Taif University, Taif, Saudi Arabia.
E-mail: y43904004@gmail.com

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Introduction

A lateral cephalometric radiograph displays cranial, facial, and oral anatomic structures imaged from the side aspect, which aids in diagnosis, treatment planning, and prognosticating the treatment result. It is used to assess craniofacial morphology, permitting to differentiate between dentoalveolar malocclusions and skeletal diversity.[1]

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The sella turcica (ST) is a distinct anatomical feature situated within the sphenoid bone, and it takes the form of a saddle-shaped depression. It is also referred to as the pituitary fossa due to its association with the pituitary gland. The boundaries of the ST are defined by the tuberculum sella in the anterior region, the dorsum sella in the posterior region, and the roof of the sphenoid sinus in the inferior region.[2]

The ST holds significance because of its proximity to vital structures within the skull. It is located in close proximity to important structures such as the optic chiasm, cavernous sinus, hypothalamus, and sphenoid sinus. The pituitary gland, which plays a crucial role in hormone production and regulation, is specifically situated within the ST.[2]

The ST, specifically its central point known as the sella point, holds significant importance in orthodontic cephalometry landmarks and plays a crucial role in the analysis of images. It serves as a key reference point for orthodontists when examining craniofacial structures and planning orthodontic treatments.

During embryonic development, it is noteworthy that the anterior and posterior sections of the ST develop independently. The anterior section originates from neural crest cells, which are multipotent cells capable of differentiating into various tissue types. However, the posterior section arises from the para-axial mesoderm, a specific layer of mesodermal tissue formed along the midline of the developing embryo.

These findings regarding the developmental origins of the ST provide valuable insights into its structure and potential variations. This knowledge is particularly relevant for orthodontic professionals and other researchers involved in the analysis of radiographic images and the examination of craniofacial anatomy related to ST.[3]

The potential correlation between anatomical variations of the ST and dental anomalies has been a topic of interest among researchers. In particular, the association between ST bridging (STB) and dental anomalies has garnered attention. However, the available data are limited, and extensive research on the association between STB and various types of dental anomalies is lacking.

STB is considered a common variation, which may possibly be linked to multiple systemic developmental syndromes. Exploring this association could provide valuable diagnostic parameters that help confirm or predict the susceptibility to certain dental challenges, such as dental transposition and canine impaction.

It is important to note that further research is needed to fully understand the relationship between STB and dental anomalies. Conducting comprehensive studies in this area would contribute to our knowledge of craniofacial development and improve our ability to diagnose and predict specific dental conditions.[4]

Dental anomalies can be caused by varied factors, including hereditary, epigenetic, and environmental impacts. Although numerous studies have been conducted on the common event of varied dental irregularities, many have looked into the connection between bridging of the ST and dental anomalies.

Canine impaction is one of the types of dental anomalies. For numerous generations, orthodontists have struggled with canine impaction. Examinations can be an effective way to reduce the cost and treatment time of cases. Eliminating the third molar, the maxillary canine is the most typically impacted. Some research studies insist that STB is more common in cases with impacted canines, while others insist there is no significant link between impacted canines and STB.[5]

Aims of the Study

1. To assess and compare the shape, size, and bridging of ST in subjects of Taif with different skeletal classifications.
2. To find whether there is any association between dental anomalies and STB.

Material and Methods

The study obtained ethical approval from the research ethics committee of Taif University with application no. 44-354 and with no. HAO-02-T-1 dated June 4, 2023.

In vitro cross-sectional retrospective study was conducted for 1 month.

Sampling and population (including inclusion and exclusion criteria) are as follows:

In this research, cephalometric radiographs taken before treatment were analyzed for 87 patients from the local population of Taif, ranging in age from 9 to 30 years. The patients were divided into two groups based on the presence or absence of STB. Group 1 comprised 38 case records showing STB, while group 2, the control group, comprised 49 case records without STB, divided as follows:

a. Group 1: 49 control records
b. Group 2: 38 case records with STB

The sample size was estimated based on the estimates of variables in previous studies. The sample size calculation was performed using an online sample size calculator, with a confidence level of 95% and a margin of error of

5%. A minimum of 73 samples were required to conduct the study. Finally, 87 subjects were recruited.

Retrospective records of orthodontic patients were reported to the preventive dentistry department, orthodontic division in the University Dental Hospital, Taif University, Taif, Saudi Arabia. An example of STB from the sample shown in Figure 1.

The dental anomalies evaluated are canine impaction ectopic eruption, congenitally missing teeth, dilacerated root, supernumerary tooth, supernumerary root, and gemination.

This is a study conducted at the University Dental Hospital, Taif University, Taif, Saudi Arabia.

Until the date of research. The conclusion was drawn based on the sample size that was available.

It is mentioned as one of the limitations of our study because of the lack of a large sample size.

Statistical analysis

A one-way analysis of variance was used to check for intergroup differences.

The Chi-square test was used to find out the association between dental anomalies in the control group and the STB group by a statistician (one of the authors).

Statistical Package for the Social Sciences (SPSS) 11.0 and Systat 8.0 statistical software packages were used.

Results

The case and control sizes and their percentage distribution are depicted in Table 1 and Figure 2. The results of our study were promising in relation to STB, and the occurrence of dental anomalies in both the case and the control with the frequencies of occurrence is 46.94% and 36.84%, respectively [Table 2]. It was found to be statistically significant as per the evaluation by the statistical Chi-square test [Table 3 and Figure 3].

The distribution of occurrences of various dental anomalies in the classes of malocclusion was also a part of this study. It was found that the percentage of distribution was more among class 1 malocclusions and least in class III [Table 4 and Figure 4].

Table 5 and Figure 5 depicts the dental anomalies occurring in the order of their percentage. It is imperative that impaction (13.8%) is the most associated anomaly, followed by ectopic eruption (11.5%). Supernumerary teeth and gemination were the least associated with STB, and only 1% of the cases showed an association.

Statistically significant associations were found for all types of dental anomalies as a result of distribution among cases and controls. Table 6 depicts a *P* value of 0.052, showing a statistically significant association between the occurrence of dental anomalies in cases with STB and the controls without STB.

Discussions

Many studies can be cited in the literature regarding the study of anatomy of sella turcica and it's use as a diagnostic tool for the malocclusions as well as dental

Table 1: Case and control sizes and their percentage distribution

Size of control and cases	Frequency	Percent
Control	49	56.3
Case	38	43.7
Total	87	100.0

Table 2: Dental anomalies and their percentage of distribution in case and controls

Dental anomalies	Yes	No	Percentage	Yes	No
Cases	23	15		46.94	39.47
Controls	14	35		36.84	92.11

Table 3: Statistically significant association of presence of STB with cases selected as samples for the study

Number of cases	Number of control	STB		Chi-square	*P*
		Present	Absent		
Case_control	Control	0	49	0.000	
	Case	38	0		0.000
Total		38	49		

P<0.005

Table 4: Distribution of various dental anomalies in different classes of malocclusion

Number of skeletal malocclusions	Type of malocclusion	Frequency	Percent
Valid	Class I	53	60.9
	Class II	29	33.3
	Class III	5	5.7
	Total	87	100.0

Table 5: Distribution of various dental anomalies in STB cases

Type of anomaly	Frequency	Percent
None	55	63.2
Impaction	12	13.8
Ectopic eruption	10	11.5
Congenitally missing	5	5.7
Dilacerated root	2	2.3
Supernumerary tooth	1	1.1
Supernumerary root	1	1.1
Gemination	1	1.1
Total	87	100.0

anomalies.[6-11] Sella turcica bridging studied as a diagnostic marker using various diagnostic aids like autopsy material, neuroradiology method, histology and lateral cephalometric radiography.[12-16]

The association of dental anomalies and the STB studies across different ethnic groups and various countries to find association with incisors anomalies and canine impactions.[17,18] In our study, we found a statistically significant value for the presence of dental anomalies in patients with STB. There are various studies showing significant association of dental anomalies with STB.[19-22] The findings of our study are consistent with those of another research conducted in 2022, which states a significant association between occurrence of dental anomalies in number and size of teeth higher in cases with STB.[4]

The sequence of dental anomalies with higher percentages of relation to STB was found to be in class I malocclusion, followed by class II, and least in class III [Table 4 and Figure 2].

These results of the relation between malocclusion types and dental anomalies and STB are in accordance with studies such as Divya Siddalingappa "STB in patients with DA was 22.3%, while 9.7% in the control group."[6]

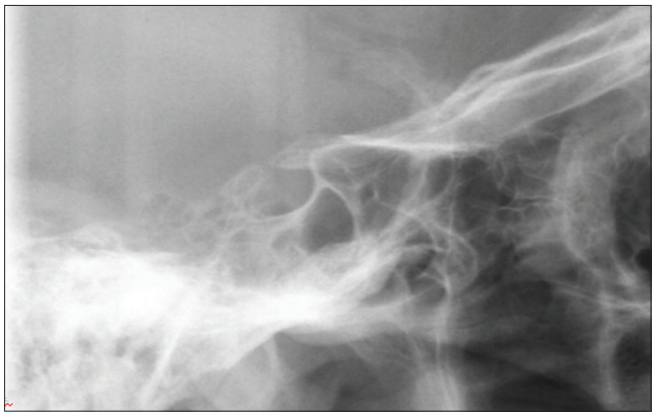

Figure 1: Patient with sella turcica bridging

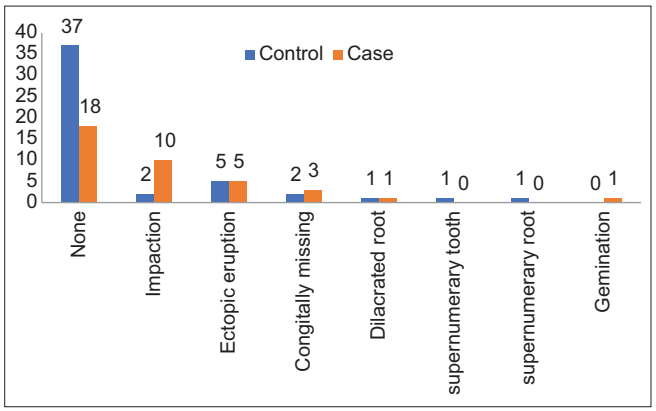

Figure 3: Distribution of dental anomalies among cases and controls

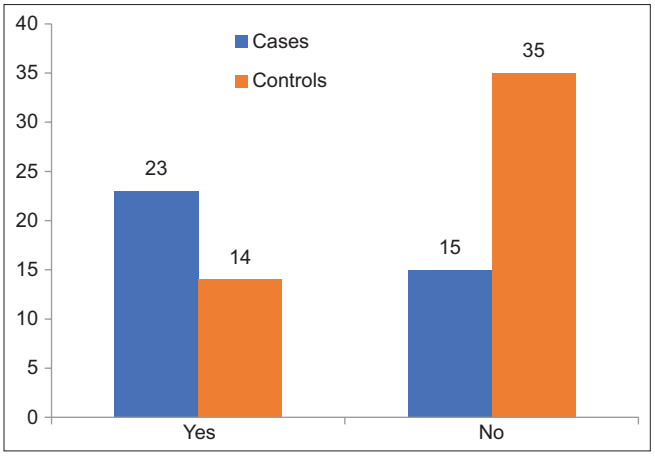

Figure 2: Dental anomalies and their percentage of distribution in cases and controls

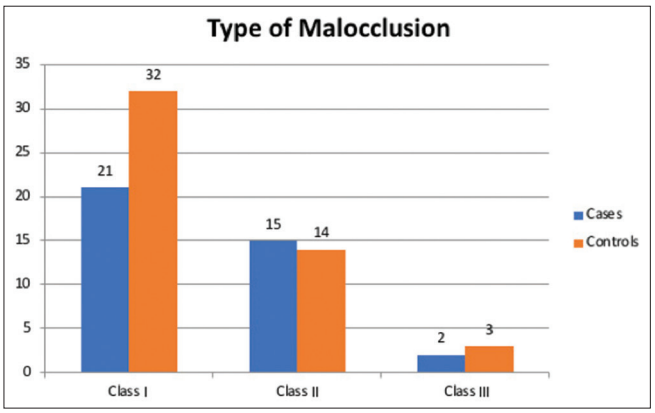

Figure 4: Distribution of various dental anomalies in different classes of malocclusion

Table 6: Distribution of dental anomalies among cases and controls and their statistical significance

Number of cases and controls with STB	Dental anomaly								Chi-square	*P*
	None	Impaction	Ectopic eruption	Congenitally missing	Dilacerated root	Supernumerary tooth	Supernumerary root	Gemination		
Number of controls with STB	37	2	5	2	1	1	1	0	13.929	0.052
Number of cases with STB	18	10	5	3	1	0	0	1		
Total	55	12	10	5	2	1	1	1		

Consider significance where the *P* value is<0.05

Figure 5: Patient with STB having maxillary canine impaction

Furthermore, some reports have indicated a potential correlation between the occurrence of STB and the type of malocclusion. These reports suggest that there is a higher frequency of STB in individuals with class II and class III skeletal patterns compared with those with a class I skeletal pattern "class III 16.8%, in comparison with skeletal class I patients 9.4%."[7,8]

STB and types of dental anomalies

Most common type of dental anomaly associated with STB was found to be canine impaction and several studies confirm this association of STB and canine impaction.[23,24] The impaction of maxillary canine was found to be associated more with an STB study conducted in 2020 by Nikoo Ghasemi *et al*.[5]

In our study, the most associated dental anomaly with STB was canine impaction with a percentage of occurrence of 55.55. Our study is in agreement with another study conducted in 2020 by Nikoo Ghasemi *et al*.[5]

In line with the present study, Dadgar *et al*. (2020)[9] conducted a study on 46 patients with canine impaction and 46 patients with normal canine eruption. The results showed that palatal canine impaction is positively associated with STB. With an increased rate for more than 2.5 times.

Statistical analysis revealed a significant association between dental anomalies and STB. The group with STB exhibited a higher prevalence of anomalies related to eruption and tooth shape compared with the group without STB.

Canine impaction was identified as the most prevalent dental anomaly in our study. Consequently, early detection and intervention of dental anomalies can significantly reduce the duration, cost, and complexity of treatment required for permanent dentition.

The least associated dental anomalies with STB in all the types of malocclusion were found to be supernumerary tooth and gemination. These results of our study agree with those of other studies.

According to Divya S, a positive association was observed between the occurrence of STB and impacted number of controls with STB canines as well as hyperdontia. The frequency of STB was found to be significantly higher in patients with impacted canines and hyperdontia compared with the control group. "Impacted canines and hyperdontia were 17.9% and 21.7%, whereas 5.6% was found in the control group."[10]

The study by Scribante A *et al*.[11] in 2017 also found the prevalence of an STB in relation to various dental anomalies such as palatally and vestibularly impacted canines, upper lateral incisors, lower second premolar agenesis, and hyperdontia.

Accurate diagnosis of incidental pathologies or uncommon normal variations is crucial to prevent the mismanagement of patients. The lateral cephalometric radiograph is a valuable tool that can reveal various pathologies with implications for physicians. Therefore, orthodontists should carefully examine lateral cephalograms not only for dental anomalies but also for non-dental anomalies.

There are studies conducted to find an association of STB with different skeletal malocclusions in different populations.[25-28] This study was conducted at Taif for the first time in this region, which adds to the larger data and associations to be linked between STB and to the specific skeletal malocclusion.

In this way, it would be beneficial to know the association between STB and skeletal malocclusions associated with specific anomalies, such as canine impaction, to help in early diagnosis and treatment plan.

Limitations

In the study, lateral cephalograms were utilized, which are two-dimensional representations of three-dimensional objects and are subject to their own limitations, including errors in landmark identification and tracing. As a result, cone-beam computed tomography (CBCT), a three-dimensional imaging technique, could provide a more accurate representation. However, the routine use of such imaging techniques in orthodontic patients is not recommended due to the higher radiation exposure associated with them.

To obtain more significant results, it would be beneficial to include a larger sample size, encompassing individuals with different types of dental anomalies. This would enhance the statistical power and generalizability of the findings.

Conclusions

Orthodontists commonly employ lateral cephalograms for routine diagnosis and treatment planning. These images can also serve as valuable prediction tools for dental anomalies. By detecting skeletal anomalies at an early stage, clinicians can anticipate the likelihood of future dental anomalies, enabling them to implement preventive measures.

The use of lateral cephalograms allows orthodontists to assess the skeletal structures and identify any deviations or abnormalities that may impact dental development. Early detection of such skeletal anomalies provides an opportunity to intervene and take proactive measures to prevent or minimize the occurrence of dental anomalies later in life. This proactive approach can significantly contribute to effective treatment planning and better patient outcomes.

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Conflicts of interest

There are no conflicts of interest.

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