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A correlative study of sella turcica bridging and dental anomalies related to size, shape, structure, number and eruption of teeth

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Abstract

OBJECTIVE: The main objective of this study is to get a wider and clearer idea about the relationship between sella turcica bridging and the type of dental anomalies related to size, shape, number, structure and eruption of teeth.

MATERIALS AND METHODS: For the present study, 50 pretreatment lateral cephalometric radiographs showing complete sella turcica bridging were retrieved from the 500 existing case records of patients. The control group consisted of 50 pretreatment lateral cephalograms without sella turcica bridging retrieved from the same case records by using simple random sampling. After collection of the samples, retrospective study was performed with the analysis of patient records to assess any associated dental anomaly in patients with sella turcica bridging and patients without sella turcica bridging. Shafer's classification of morphological variations in size, shape, structure, number and eruption of teeth was used to analyze and group the dental anomalies.

RESULTS: The incidence of dental anomalies related to number and size of teeth was found to be higher in cases with sella turcica bridging.

CONCLUSION: Lateral cephalogram is used by orthodontist routinely for diagnosis and treatment planning; it can be used as a prediction tool for dental anomalies as well. Early detection of skeletal anomalies can be used to forecast the presence of dental anomalies later in life, which will help the clinician to adopt preventive measures.

Keywords:

Dental anomalies, lateral cephalogram, orthodontist, sella turcica bridging, skeletal anomalies

Introduction

Although pretreatment lateral cephalograms are mainly used for evaluation of skeletal and dental patterns as a basis for predicting facial growth, they are skull radiographs and contain other diagnostic information about the skull, face and upper cervical spine. Despite the fact that orthodontic patients are generally healthy young individuals, there are

reports of occult pathology involving the head or spine discovered incidentally in cephalometric radiographs of orthodontic patients. We must not forget that the field of Orthodontics is concerned with the health of the entire individual.^[1]

On the other hand, normal anatomy varies among individuals and can simulate the disease. Proper diagnosis of incidental pathoses or rare normal variants is important to avoid patient mismanagement and requires familiarity with the anatomy and pathology of the head and neck region.^[2]

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Most of these pathological conditions, developmental abnormalities or normal variants are associated with a significant problem in other body systems. Interestingly, some of these findings are detectable very early in life and often precede other signs or symptoms in syndromes. Therefore, in some cases, they could potentially be valuable for an early diagnosis.^[3]

The sella turcica is an important anatomical structure for cephalometric assessment because of its central landmark. It lies on the intracranial surface of the body of the sphenoid and consists of a central pituitary fossa. Two anterior and two posterior clinoid processes project over the pituitary fossa. Fusion of the posterior and anterior clinoid processes is known as a sella turcica bridge. There are two types of bridging depending on their radiographic appearances [Figures 1 and 2].^[4]

The anterior and posterior walls of the sella turcica have different developmental origin where the anterior wall develops from the neural crest cells and the posterior wall develops from paraxial mesoderm under the direct influence of notochord.^[5,6]

Recently, some studies have been done to establish association of craniofacial skeletal anomalies with dental anomalies. This relationship may be based on the involvement of neural crest cells and/or homeobox or hox genes during the development stage. It appears that tooth formation and its eruption and sella turcica bridge calcification, as well as neck and shoulder skeletal development, are influenced by neural crest cells.^[3]

Sella turcica bridging is likely to complement the diagnostic parameters that confirm or predict the susceptibility of certain dental problems. These include dental transposition and canine impaction.^[7]

It was supposed that anatomic deviations of sella turcica could be associated with dental alterations. So, the association between sella turcica bridging and dental anomalies has been an area of interest for many researchers.^[8-10] The data is very limited and not much work has been done with regard to the association of sella turcica bridging and all types of dental anomalies. Research work has been done to find association between impacted teeth and missing teeth with sella turcica bridging but when it comes to anomalies related to size, shape and structure, there is no data available. So, the main purpose of this study is to get a wider and clearer idea about the relationship between sella turcica bridging and the type of dental anomalies related to size, shape, number, structure and eruption.

Materials and Methods

In the present study, pretreatment cephalometric radiographs of 100 patients of the local population of Karnataka aged 7-30 years were retrieved from 500 existing case records. They were grouped into two groups based on the presence or absence of sella turcica bridging. Group 1 consisted of 50 case records with sella turcica bridging and Group 2, control group consisted of 50 case records without sella turcica bridging retrieved by using simple random sampling.

Group 1: 50 case records with sella turcica bridging

Group 2: 50 case records without sella turcica bridging

Armamentarium

Case records consisted of the following:

1. High quality radiographs which were taken by trained radiographic technicians in a standardized manner with the clearest reproduction of sella turcica area
2. High-quality orthodontic study models
3. High-quality orthopantomograms
4. High-quality intraoral periapical radiographs
5. High-quality occlusal radiographs
6. High-quality intraoral and extraoral photographs
7. Case history records of patients.

After collection of the samples, retrospective study was performed with the analysis of patient records that included case history, orthodontic study models, orthopantomograms, intraoral and extraoral photographs, intraoral periapical radiographs and occlusal radiographs. The purpose of this analysis was to assess any associated dental anomaly in patients with sella turcica bridging and patients without sella turcica bridging.

According to Shafer, dental anomalies are broadly classified under five headings:^[11]

1. Dental anomalies related to size:
 - Microdontia
 - Macrodontia.
2. Dental anomalies related to shape:
 - Gemination
 - Fusion
 - Concrescence
 - Dilaceration
 - Talon cusp
 - Dens in dente
 - Dens evaginatus
 - Taurodontism
 - Supernumerary roots.
3. Dental anomalies related to number:
 - Anodontia
 - Supernumerary teeth
4. Dental anomalies related to the structure of teeth:
 - Amelogenesis imperfecta

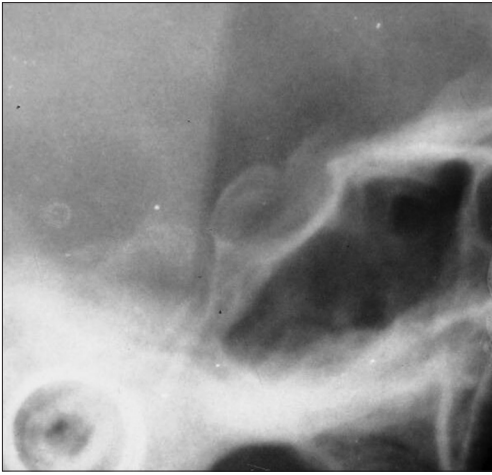


Figure 1: Sella turcica bridging Type A (ribbon-like fusion)

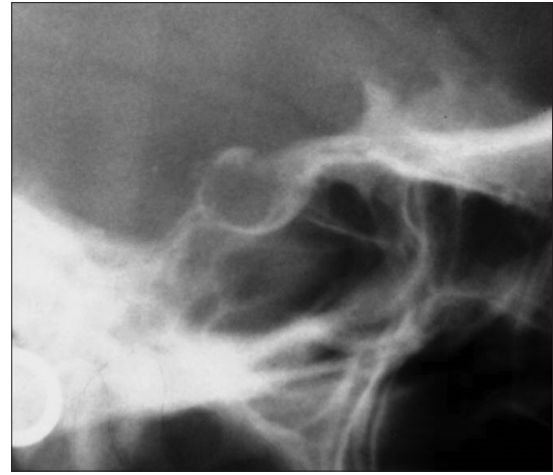


Figure 2: Sella turcica bridging Type B (thinner fusion with extension of anterior and/or posterior clinoid process)

- Dentinogenesis imperfecta
- Dentin dysplasia
- Regional odontodysplasia.

5. Dental anomalies related to eruption:

- Premature eruption
- Eruption sequestrum
- Multiple unerupted teeth
- Embedded and impacted teeth

Considering this classification, the morphological variations in size, shape, structure, number and eruption of teeth were analyzed and grouped. Correlation between sella turcica bridging and dental anomalies was evaluated.

Statistical method

1. Chi-square test^[12]:

Chi-square test was used in this study.

It was used

To find out the association of dental anomalies in the group with sella turcica bridging and without sella turcica bridging.

Statistical software

The Statistical software, namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables, etc.

Results

After comparing the morphological variations of dental anomalies related to size, shape, number, structure and eruption in the group with sella turcica bridging and without sella turcica bridging, the following results were obtained [Table 1 and Figure 3].

Anomalies of size

Anomalies of size were present in 18% cases with sella turcica bridging and 2% cases without sella turcica bridging. Higher number of patients with sella turcica bridging were found to be associated with the anomaly of size compared to those without sella turcica bridging. This association was statistically significant (P -value < 0.05).

Anomalies of shape

Anomalies of shape were present in 16% cases with sella turcica bridging and 8% cases without sella turcica bridging. This association was not statistically significant (P -value > 0.05).

Anomalies of number

Anomalies of number were present in 50% cases with sella turcica bridging and 14% cases without sella turcica bridging. Higher number of patients with sella turcica bridging were found to be associated with anomalies of number compared to those without sella turcica bridging. This association was statistically highly significant (P -value < 0.001).

Anomalies of structure

Anomalies of structure were present in 16% cases with sella turcica bridging and 12% cases without sella turcica bridging. This association was not statistically significant (P -value > 0.05).

Anomalies of eruption

Anomalies of eruption were present in 18% cases with sella turcica bridging and 10% cases without sella turcica bridging. This association was not statistically significant (P -value > 0.05).

Discussion

After comparing the morphological variations of dental anomalies related to size, shape, number, structure and

Table 1: Analysis of anomalies associated in each group (with/without bridging)

| Anomaly | With Bridging (n=50) | | | | Without Bridging (n=50) | | | | Chi-square | P |
|-----------|----------------------|----|--------|----|-------------------------|----|--------|----|------------|----------|
| | Present | | Absent | | Present | | Absent | | | |
| | n | % | n | % | n | % | n | % | | |
| Size | 9 | 18 | 41 | 82 | 1 | 2 | 49 | 98 | 7.111 | 0.008* |
| Shape | 8 | 16 | 42 | 84 | 4 | 8 | 46 | 92 | 1.515 | 0.218 |
| Number | 25 | 50 | 25 | 50 | 7 | 14 | 43 | 86 | 14.89 | <0.001** |
| Structure | 8 | 16 | 42 | 84 | 6 | 12 | 44 | 88 | 0.332 | 0.564 |
| Eruption | 9 | 18 | 41 | 82 | 5 | 10 | 45 | 90 | 1.329 | 0.249 |

*Significant. **Highly significant

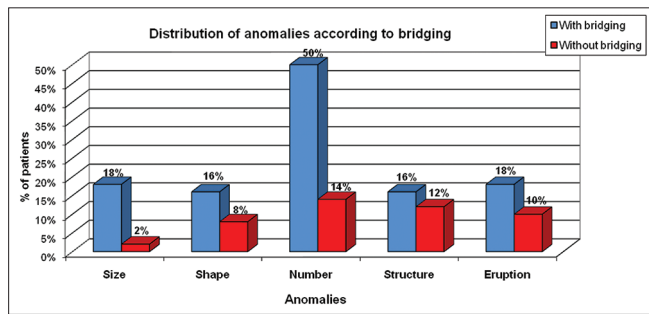


Figure 3: Graph of distribution of dental anomalies according to the presence of bridging

eruption with the group with sella turcica bridging and the group without sella turcica bridging, it was found that the association between anomalies of number and size was found to be statistically significant ($P < 0.05$). Anomalies of number and size were present more in the group with sella turcica bridging compared to the group without sella turcica bridging.

The incidence of anomalies of number was more in the group with sella turcica bridging as compared to the group without sella turcica bridging. This finding is consistent with the study done by Rosalia Leonardi, Ersilia Barbato, Maurizio Vichi and Mario Caltabian, where they investigated congenital absence of second mandibular premolar and palatally displaced canine in association with sella turcica bridging. They found that the prevalence of sella turcica bridging in adolescents with these dental anomalies had increased.^[13] These findings are also similar to the study done by Alqahtani H. In this study, he compared sella turcica bridging among the orthodontic patients with congenital missing maxillary lateral incisors (CMMLI) and individuals with complete dentition. He found that the patients with CMMLI tended to have an increased frequency of sella turcica bridging and decreased sella turcica length.^[7]

The possible explanation for the above finding could be the involvement of either evolution or genetics. Agenesis of a tooth or teeth is the most common anomaly of dental development in human beings.^[11] One of the reasons for this is phylogenetic changes in the dentition that correlate with the functional adaptation.^[14] Teeth and

teeth-bearing bones evolve together.^[15] The reduction in teeth number is concomitant with the reduction in the size of the jaws in human evolution and is believed to be a continuing evolutionary trend. The number of teeth diminishes in parallel with these changes in the jaw skeleton.^[16]

Tooth agenesis is the most common congenital dental anomaly where teeth are missing due to a developmental failure. Congenitally missing teeth are not able to develop sufficiently to allow the differentiation of the dental tissues.^[17] Furthermore, it is defined as the missing of one or more teeth and can be observed in sporadic or hereditary syndromes.^[18] Molecular studies of odontogenesis, using the mouse tooth as a model, have shown that the tooth development is under strict genetic control, which determines tooth position, number, size and shape.^[19-21]

The majority of cases involving hypodontia and oligodontia are due to genetic factors. Mutations of several genes are associated with the syndromic tooth agenesis. To date, the familial and sporadic forms of tooth agenesis have been associated with mutations in MSX1 and PAX9.^[22] Interestingly, MSX1- and PAX9-deficient mice exhibited several other craniofacial abnormalities.^[23,24]

Statistically significant association was found between the group with sella turcica bridging and the group without sella turcica bridging with regards to anomalies of size ($P < 0.01$). Higher numbers of patients with sella turcica bridging were found to be associated with anomalies of size as compared to those without sella turcica bridging. In this category, anomalies related to size were mainly cases with peg-shaped laterals and cases with rudimentary third molars. Woolf has suggested that peg lateral incisors or rudimentary third molars may reflect incomplete expression of gene defect that causes tooth agenesis. As the agenesis of teeth is the most common anomaly of tooth development, Grahnen has suggested that tooth agenesis is typically transmitted as autosomal dominant trait. Its incomplete penetrance and variable expressivity must have given rise to an increased number of anomalies related to size of the

tooth.^[25] As the third molar and maxillary lateral incisor are the most commonly missing teeth, their rudimentary appearance supports this hypothesis.

No statistically significant association was found between the anomalies of shape, eruption and structure in the group with sella turcica bridging and the group without sella turcica bridging ($P > 0.05$). In all these anomalies, though, genetics plays an important role, they can also be influenced by other local environmental factors. This could be one of the reasons for their insignificant association with sella turcica bridging.

These findings are in accordance with the study done by Pamela M. Ortiz, Sawsan Tabbaa, Carlos Flores-Mir and Thikriat Al-Jewair, where they investigated the association between unilateral/bilateral maxillary canine impaction and sella turcica bridging using cone beam computed tomography imaging. They found that there is no statistically significant association between unilateral/bilateral palatal canine impaction and sella turcica bridging when using 3D CBCT. This study suggests that other factors warrant investigation when discussing the association and occurrence of maxillary canine impaction and sella turcica bridging. Sharing common embryologic origins and gene mutations may not justify the link and the two findings maybe occurring independent from one another.^[26]

The etiology of anomalies related to eruption is not fully understood, but there are a number of factors that were identified as possible etiologies, such as failure of root resorption in the primary teeth, abnormal eruption path, presence of supernumerary teeth, crowding, oversized dental follicle and genetics, in addition to other factors.^[27,28] Similarly, sella bridging can be the result of physiological activities of the chemical compounds that are involved in the embryogenesis and buildup of bone.^[29] Future studies are needed to clarify the etiologies and further investigate the link between sella turcica bridging and dental anomalies related to shape, structure and eruption.

The structure of the sella turcica can be seen on the lateral cephalometric radiographs, and it is routinely traced as a part of cephalometric analysis. The morphology of the sella turcica is important in establishing a cephalometric reference point.^[30]

Anatomical and cephalometric evidence of sella turcica bridging is an anomalous finding, and its presence has been linked to various entities including syndromes, craniofacial and dental abnormalities.^[4,5] Some studies have advocated using the presence of sella turcica bridging as a diagnostic marker to alert clinicians of the potential presence of other disease entities/anomalies.^[10]

This anatomical variation of the sella turcica may reflect the developing pathological conditions of the oral cavity which may alert the clinician in predicting the susceptibility to dental anomalies. Dental agenesis is considered as an important clinical and public health problem.^[31] Patients with missing permanent teeth may suffer from inarticulate pronunciation, a reduced chewing ability and an unfavorable aesthetic appearance.^[32] This generally affects their self-esteem, communication behavior and professional performance.^[33] Therefore, early diagnosis and intervention of dental anomalies can reduce the duration, expense and complexity of the treatment in the permanent dentition.

Proper diagnosis of incidental pathoses or rare normal variants is important to avoid patient mismanagement.^[2] The lateral cephalometric radiograph can disclose a variety of pathoses which are of significance to the physician. The orthodontist should, therefore, study the lateral cephalograms for nondental anomalies.^[1]

Conclusions

The conclusions from this study were the following:

1. Incidence of dental anomalies of number and size of teeth was found to be higher in cases with sella turcica bridging.
2. There was no significant association found between dental anomalies of shape, eruption, structure of teeth in the group with sella turcica bridging and the group without sella turcica bridging.

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Conflicts of interest

There are no conflicts of interest.

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