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Relation Between Sella Turcica Bridging and Palatal Canine Impaction – A Review

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Abstract

Anatomical variations in sella turcica are associated with various types of syndromes, craniofacial, and dental abnormalities. The one of interest to orthodontists is palatal impaction of canine. It has been advocated that the dental progenitor cells and anterior wall of the sella-turcica share a common embryological origin, and neural crest cells play an important role in the development of both. The early diagnosis and intervention for impacted canines can reduce the duration, expense, and complexity of treatment in the permanent dentition. A proper knowledge of normal variants and pathologies that are associated with sella turcica bridging is required. Lateral cephalograms and CBCT should be studied thoroughly to observe the presence of STB and its association with PCI. The present review aimed at getting a much clearer association of bridging of sella turcica with palatal impaction of canine.

Keywords: *Lateral Cephalogram, Orthodontist; Palatal Canine Impaction; Sella turcica bridging.*

Introduction

Sella turcica (ST) is an anatomical saddle-shaped depression or fossa, which is located in the body of sphenoid bone, in the mid-cranial area, extending from the Tuberculum Sella to Dorsum Sella. It also incorporates the pituitary gland, over which two anterior and two posterior clinoid processes project and get fused together to form a sella turcica bridge (STB), due to calcification of the Interclinoid Ligament (ICL). Sella turcica (ST) is a central landmark and it plays a significant role in cephalometric evaluation [1]. The prevalence rate of STB ranges from 1.75-6% and it is found to be associated with various anomalies and syndromes like Rieger syndrome, Gorlin–Goltz syndrome, Axenfeld–Rieger syndrome, and severe craniofacial deviations [2].

Different studies advocated that anatomical variations in sella turcica are associated with various types of dental abnormalities [3-5], one of them being, palatal impaction of canine, and this relation is of fanatical interest from many years [6-8]. Maxillary canine impaction is a well-recognised anomaly affecting around 1 to 2% of people. If it is left unmanaged, impaction of canine can cause various abnormalities like mobility and malpositioning of tooth, resorption of root, formation of dentigerous cyst, and arch-length discrepancy [9].

Various theories have been proposed to explain the association between palatal impaction of canine and sella-turcica. It has been advocated that the dental progenitor cells and anterior wall of the sella-turcica share a common embryological origin, and in the development of both, neural crest cells play an important role. It has also been found that the

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development of teeth, midface, palatal, maxillary, frontonasal areas and sella-turcica got disrupted because of faulty signalling pathways when genomic mutations occur in expressing the homeobox gene that consists of neural crest cells [10].

The probable correlation between the bridging of sella-turcica and dental anomalies like palatal canine impaction has been evaluated by different radiographic studies done in the past [9,11-12]. These studies have found a raised frequency of STB in subjects having dental anomalies. Although studies have been done to find the association between sella turcica bridging with palatal impaction of canines, but still data is very limited about the association between sella turcica bridging, with dimensions and severity of impaction of palatally displaced canines. Thus, this present review aimed at getting a much clearer and broad knowledge regarding the association of bridging of sella turcica with the severity of impaction and another dimension of palatally displaced canines.

Sella turcica bridging and palatally impacted canines

Etiology

It has been postulated that both the walls of sella turcica have different developmental origins. Development of the posterior sella turcica wall occurs from the paraxial mesoderm under the direct effect of the notochord, whereas the origin of the anterior wall is from the neural crest cells [9]. Recent research has established an association between dental and craniofacial anomalies. This association is based on the role of homeobox or hox genes and neural crest cells during the development stage. It has been found that the skeletal development of the neck and shoulder; sella turcica bridge calcification; and formation and eruption of the tooth are influenced by neural crest cells [7-10].

Diagnosis

Diagnosing the impacted canines in young children is always a matter of concern for orthodontists. Timely diagnosis of impacted canines can be a necessary factor to start the orthodontic intervention in time, thus reducing the cost, complexity and time of treatment [13]. Besides conventional radiographic methods, various authors have been using the traditional 2D lateral cephalograms for diagnosing the sella turcica bridging. In orthodontic practice, cephalometry is a regular tool of diagnosis, but its use in diagnosing STB is limited because of magnification and projection errors, causing structure overlap. Because of the 2D nature of lateral cephalograms, information on the left as well as the right STB cannot be obtained [14]. Recent advancements in craniofacial imaging using cone beam computed tomography (CBCT) have made it feasible to get 3D images of craniofacial structures. CBCT has also addressed the 2D lateral cephalometry limitations.

Palatally Impacted Canine

The increased prevalence of sella turcica bridging in cases showing palatal canine impaction (PCI) is generally related to the shared embryological basis of dental as well as craniofacial structures. Advocate that the anterior wall of sella turcica is perhaps liked with variations in the maxillary and frontonasal fields [15]. Clinically, if one suspects the future development of PCI, orthodontist's advise deciduous canine extraction or arch expansion. Indication for treatment is related to the availability of particular factors like improper positioning of the crown of the canine on the panoramic radiograph, asymmetrical eruption of the permanent maxillary canine, congenitally missing, reduced size or a peg-shaped lateral incisor. Some authors advocated that the presence of sella turcica bridging can be an important predictive factor for PCI.

There are two types of sella turcica bridging (Types A and B). Evaluation of radiologic

images of sella turcica bridging (Types A and B) on lateral cephalogram has not yet been assessed about the impacted canine development [14]. The question arises as to whether assessing of the morphological variation of sella turcica could be useful in clinical practice. A study conducted observed that the prevalence of complete sella turcica bridging was considerably higher in patients with PCI but no significant differences has been observed in the Type A (ribbon-like fusion) and Type B (extension of clinoid processes) sella turcica bridging [16]. The anteroposterior diameter and length of sella turcica was found to be significantly more in cases having PCI. They did not find any significant difference about the depth of sella turcica. The authors found that complete bridging of sella turcica occurred more commonly in cases with PCI.

In one of the studies done, it was observed that the prevalence of sella turcica bridging was higher in cases showing canine impactions whereas the diameter, length and depth of sella turcica was decreased in cases having canine impactions [17]. In canine impaction cases, the length of sella was longer in males than females. The incidence of complete or partial bridging in cases with impacted canines was around 4 times more than those with erupted permanent canines.

In a study, it was stated that the palatally impacted canine was associated with the sella turcica bridging [18]. Therefore, they advocated that sella turcica bridging can be used as a diagnostic parameter for palatally impacted canines.

Pathogenesis

Sella turcica is the main region for the exodus of neural crest cells to frontonasal, maxillary, and palatal units of development. It is recognised that the sella turcica and canines have a common embryological development; thus, any variation at the level of development can result in the bridging of sella, that can further cause the impaction of canines [16]. The bridging of Sella turcica reveals the chances of palatal canine impactions in future, mainly in children having a history of canine impaction in their siblings or parents.

This study stated that a thorough clinical understanding of outcomes is that, bridging of sella can cause the possibility of palatal canine impactions in future [19]. Thus, it is required to carefully examine the timing of eruption of the maxillary canines in children being diagnosed with complete sella turcica calcification.

A significant correlation has been observed between the severity grade of STB and PCI in a study [20]. The ratio of length: to diameter of the sella turcica was not significantly associated with the relationship of STB and PCI. There was no significant relationship observed between gender and STB.

Clinical Implications

Followed by the third molars, the maxillary canines are observed to be the most commonly impacted teeth. The association between PCI and STB can be utilized as the early diagnostic indicator for confirming the PCI. Sella turcica bridging (STB) is utilized as a factor for predicting the relationship for helping the orthodontists in diagnosis at the earliest. The diagnosis of PCI at the earliest is useful in minimizing the cost, complexity, and duration of orthodontic treatment. Orthodontists must have adequate knowledge about the morphological sella turcica variations to distinguish between abnormal and normal morphology [21].

It was found that, a statistically significant correlation between the maxillary canine impaction with female gender, *sella turcica* bridging, calcification of *ponticulus posticus*, and the lateral incisor anomaly [22]. These factors were observed to be the significant variables and positive predictors of maxillary impacted canines, mainly related to the impaction in the palatal region. Assessment of

such radiographic and clinical elements can show a predictive sign of the probable maxillary canine impaction.

Conclusion

It has been concluded that palatal impaction of canine is usually observed in cases having sella turcica bridging. Thus, it is required that investigations like lateral cephalograms and CBCT should be thoroughly studied to observe the presence of STB and its association with PCI.

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