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Complete Transposition of Mandibular Second Premolar in a Class II Malocclusion Case Associated with Mandibular Deficiency: A Case Report

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ABSTRACT

Tooth transposition poses a significant challenge in dental clinics when it comes to treatment. The exact cause of tooth transposition remains a topic of debate and is still not fully understood. Approximately 20% of transpositions that occur in the upper arch involve the canine and lateral incisor. Although relatively uncommon, transpositions can also affect the upper central and lateral incisors. Among all transpositions, the mandibular lateral incisor-canine transposition is exceptionally rare, with a prevalence rate as low as 0.03%. Tooth transposition in the posterior side of the mandible is an uncommon occurrence. However, the present case report with complete transposition of the mandibular right second premolar erupted in the distal of the mandibular right first molar in a 12-year-old male patient with class II malocclusion is a rare case entity for clinical consideration. The current study proposed a factor or etiology, which is the correlation between the position of the tooth and inadequate growth of the mandible, as a potential explanation for complete transposition involving the mandibular second premolar. Further research and clinical studies are necessary to validate this etiology and gain a better understanding of the underlying mechanisms of tooth transposition.

Keywords: Mandibular premolar; Transposition; Mandibular deficiency; Malocclusion; Angle class II.

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Introduction

Tooth transposition is a disorder characterized by an abnormal positional change of two teeth within the same quadrant. The most common type of tooth transposition involves the upper canine and first premolar, and it is more prevalent among females [1]. Transpositions can occur in either the maxilla or the mandible, although they are less frequent in the mandible; [2] the prohibition of tooth transposition may be attributed to the higher bone density observed in the mandible [3]. In the mandible, transposition typically involves the canine and lateral incisor. It is worth noting that transpositions usually do not occur simultaneously in both arches. The prevalence of migration of premolars is low compared to other teeth, such as canines [4]. The causes of tooth transposition are not fully understood, but several factors have been suggested. These include the retention or early loss of primary teeth, trauma, transposition of tooth germs during development, and distant migration of teeth within the bone [5].

A new proposed factor that can influence tooth eruption and position is a deficiency in arch length. The mandible undergoes growth as new bone is added to the posterior surface of the ramus, while substantial bone is resorbed from the anterior surface [6]. During infancy, the ramus is located where the primary first molar will eventually erupt. As growth continues, space is created for the eruption of the primary second molar and the sequential eruption of permanent molars. However, in some cases, growth stops before enough space is generated for the eruption of the third permanent molar, leading to its impaction within the ramus. In the context of transposition involving the mandibular second premolar, which is a rare occurrence, we propose a new etiology. This etiology suggests that when the first permanent molar erupts earlier than the second premolar, and there is a deficiency in arch length and inadequate jaw growth, the first permanent molar may cause the premature loss of the second primary molar. Consequently, the first permanent molar erupts in the position intended for the second premolar. By the age of 12, when the second premolar is expected to erupt, migration of the premolar within the bone is observed, leading to its eruption distal to the first molar. In this study, with the report of complete transposition of mandibular right second premolar erupted distal to the mandibular right first molar in a 12-year-old male patient with class II malocclusion, the relationship between tooth position and insufficient growth of the mandible has been investigated. The current study proposed a factor or etiology, which is the correlation between the position of the tooth and inadequate growth of the mandible, as a potential explanation for complete transposition involving the mandibular second premolar.

Case Presentation

This case report is about a twelve-year-old male patient who was referred to our private clinic for a check-up and our treatment plan for the mandibular left second premolar (Figure 1). It should be mentioned that the patient did not report any pain or other symptoms. During history taking, we did not notice any medical or familial problems and did not find any pathological issues in soft tissue; whereas clinical and paraclinical evaluation has shown a rare circumstance: a complete transposition was observed in this patient who had class II malocclusion as well. Additionally, a vertical palisading of the first and second molars was seen on the left side of the mandible.

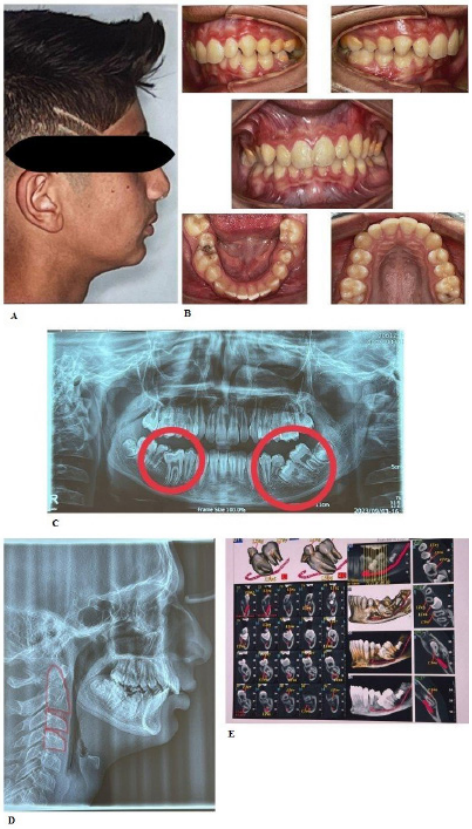

Figure 1. 12-year-old male patient with class II malocclusion, complete transposition of lower right second premolar and permanent first molar, and vertical palisading of the permanent left first and second molars. (A: Pretreatment profile view, B: Pretreatment intraoral photographs, C: Pretreatment panoramic radiograph, D: Pretreatment cephalometric radiograph, E: Pretreatment cone-beam computed tomography).

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Discussion

Tooth transposition in the mandible, particularly in the posterior region, is an uncommon occurrence [1]. In the case we reported, with class II malocclusion, we observed a complete transposition where the mandibular second premolar had switched places with the permanent first molar on the right side. On the left side, we observed a vertical palisading of the first and second molars in the mandible, forming a palisade-like structure. In general, vertical palisading of permanent molars is commonly found in the tuberosity area, indicating a lack of development in the maxilla [7]. Tooth transposition and vertical palisading in the mandible are rare occurrences [8]. Nevertheless, in the case we presented, both conditions were observed. Our proposed etiology suggests that insufficient forward growth of the mandible in patients with a class II growth pattern can contribute to tooth transposition and vertical palisading in the mandible. When the mandible is displaced forward, compensatory bone deposition occurs along the posterior margin of the ramus, while the anterior periosteal surface of the ramus undergoes resorption.

This results in an overall increase in the length of the mandible and the dental arches. Progressive modeling and remodeling of the posterior region create space for the eruption of the second primary molar and subsequently for the sequential eruption of the permanent molar teeth. Insufficient growth before adequate space has been created for the eruption of permanent teeth can lead to arch length discrepancy, and the lack of space may affect tooth position and eruption. While the present findings support a possible relationship between mandibular arch-length deficiency and posterior tooth transposition, this etiologic hypothesis is derived from a single case, and other established mechanisms of tooth transposition cannot be excluded.

A genetic contribution to tooth transposition is well documented; several authors have described a multifactorial etiology combining genetic predisposition with mechanical and developmental factors, and familial clustering together with associated dental anomalies such as peg-shaped incisors and hypodontia has been used as evidence of hereditary involvement [9,10]. A family study of maxillary canine–first premolar transposition further found an increased prevalence of ectopic and missing teeth among first-degree relatives compared with the general population, supporting a shared genetic background for tooth transposition and related dental anomalies [11]. In the present patient, no similar dental anomalies were reported among first-degree relatives and no additional developmental dental anomalies were identified radiographically; however, a formal family dental history and genetic assessment were not performed, so a hereditary contribution cannot be entirely excluded and should be regarded as a limitation of this report. It should also be noted that the genetic evidence cited above relates primarily to maxillary canine-premolar transposition and may not fully generalize to the posterior mandibular presentation described here. More importantly, because the etiology proposed in this report rests on mandibular arch-length deficiency itself, it must be acknowledged that mandibular retrognathism and the skeletal Class II growth pattern are themselves substantially heritable; candidate-gene and genome-wide studies have implicated a polygenic genetic architecture underlying mandibular growth and retrognathism [12].

This raises the possibility that a heritable predisposition toward reduced mandibular growth, rather than an independent mechanical process, could underlie both the skeletal pattern and the transposition observed in this patient. Formal family history and genetic assessment were not performed in this case, so this heritable pathway cannot be distinguished from the mechanically driven etiology proposed here and should be regarded as an additional limitation. Prolonged retention of the primary second molar beyond its normal exfoliation age is another well-recognized cause of positional disturbance in the succeeding premolar, since a retained primary molar can redirect the eruption path of its successor and allow mesial drift of the first permanent molar into the space intended for the premolar [5].

Because the patient in this report was first examined at 12 years of age, after the transposition had already occurred, an earlier, undocumented period of retention and delayed exfoliation of the primary second molar cannot be ruled out retrospectively, and this represents an alternative or contributing explanation to the proposed growth-deficiency etiology. Trauma to the primary or developing permanent dentition is also an established cause of tooth bud displacement and subsequent transposition, including reports involving the mandibular arch [13]. No history of orofacial trauma was reported by the patient or family; however, because trauma sustained in early childhood is frequently unwitnessed or unrecalled by school age, this possibility cannot be entirely excluded based on history alone. Taken together, the proposed association between mandibular deficiency and complete premolar-molar

transposition is consistent with the clinical and radiographic findings of the present case; however, it should be regarded as one of several plausible, non-mutually exclusive etiologic pathways rather than a proven causal mechanism, and further case series incorporating family history and genetic analysis are needed to test this hypothesis. The treatment of transposed teeth varies depending on the specific circumstances [14–16]. In our case, although anterior crowding was not observed, complications arising from insufficient jaw growth, such as tooth transposition and vertical palisading, were presented in the posterior region of the mandible. Additionally, pathologic findings like dental caries and crown fracture were observed in the mandibular second premolars. Therefore, it was recommended to extract the mandibular second premolars and apply functional therapy to improve the patient's jaw relationship. The palisading view on the left side will be evaluated in follow-up sessions. After the completion of functional therapy, fixed orthodontic treatment will be initiated. If the position of the palisading molars remains incorrect, skeletal anchorage may be used to correct it. It is important to note that many patients with class II malocclusions, identified between the ages of 7 and 9, should be closely monitored for intra-arch problems such as crowding, molar eruption, and tooth position. By addressing these issues at the appropriate time, preventive measures can be taken to mitigate potential complications (e.g., tooth transposition).

Conclusion

Within the limits of the present case, we can conclude that this was a rare combination of complete transposition of the lower right second premolar and permanent first molar and the vertical palisading of the permanent left first and second molars, owing to mandibular deficiency. Since the growth modification treatment of class II malocclusion is usually done during the late mixed dentition or the early permanent dentition period and due to the effect of deficiency in arch length on the position of the teeth, it is recommended to screen patients during the eruption of permanent teeth in order to take the necessary measures for intra-arch problems.

Conflict of Interest

There is no conflict of interest to declare.

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