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Maxillary Canine—First Premolar Transposition

Restoring Normal Tooth Order With Segmented Mechanics

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ABSTRACT

Tooth transpositions present at a relatively low incidence in the world population and primarily affect maxillary canines and premolars. Treatment of this disturbance should take into account aspects such as facial pattern, age, malocclusion, tooth-size discrepancy, stage of eruption, and magnitude of the transposition. Mechanics for correction should be entirely individualized, reducing the risks and adverse effects. Practitioners often select simpler options, indicating extraction of permanent teeth, which is an irreversible procedure that may bring about damages to the patient. This study presents a case report and treatment of unilateral transposition of maxillary canine and premolar with repositioning of affected teeth to their respective normal positions.

KEY WORDS: Transposition, Corrective orthodontics, Segmented mechanics.

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INTRODUCTION Return to TOC

Tooth transposition is an alteration initially reported in the 19th century,[1] and its terminology has been changing. Some publications have classified different degrees of ectopic eruption as pseudotranspositions or incomplete, partial, simple, or coronal transpositions.[2–4] Certainly, ectopic eruption is a wide category of any type of anomaly in which the teeth present an abnormal eruption pathway. Thus, tooth transposition should be considered a subdivision of ectopic eruption, being the extreme condition in this category.

A clear and objective definition of tooth transposition has been reported by Peck et al[5] as a dental anomaly characterized by the exchange of position between two adjacent teeth, especially in relation to their roots, or development and eruption of a tooth in a position normally occupied by a nonadjacent tooth.

Tooth transposition is usually associated with other dental anomalies in the same patient, such as hypodontia, peg-shaped teeth, severe rotations and bad positioning of adjacent teeth, retention of deciduous teeth, dilacerations, and malformations of other teeth.[4–8] The anomaly affects both dental arches of both males and females but is more frequent among females and in the maxillary arch.[6,9–11] Interestingly, simultaneous occurrence of transposition in both arches is seldom observed, even in the deciduous dentition.[4,5]

A possible explanation for tooth transposition would be an exchange in position between developing tooth buds.[2,12,13] Because of the high incidence of retained deciduous canines associated with tooth transposition, some authors report deciduous teeth as being the primary etiologic factor of this anomaly.[11–14] In addition, the intraosseous migration of the canine,[15] trauma to the deciduous tooth,[16] and the presence of cysts and pathologies[17] also have been suggested. However, the present data strongly attribute this disturbance to genetic influences within a multifactorial inheritance model.[5,18–20]

Peck and Peck[21] conducted a wide review of case reports of tooth transpositions in the maxillary arch and established a classification based on anatomical factors. From 201 case reports reviewed, the authors found the following conditions of transposition, in decreasing order of frequency: (1) canine–first premolar, (2) canine–lateral incisor, (3) canine on the site of first molar, (4) lateral incisor–central incisor, and (5) canine on the site of central incisor.

This study presents a case report of clinical management of unilateral tooth transposition of a maxillary right canine and first premolar. The first scientific reference on transposition of maxillary canine and premolar is probably credited to Miel,[1] who described in detail a case with bilateral transposition in 1817 and suggested the genetic involvement of this anomaly.

Transposition of the maxillary canine and first premolar presents a low prevalence in the population, being found in 0.03% of Swedish schoolchildren,[22] 0.13% of Arabian dental patients,[23] 0.25% of Scottish orthodontic patients,[24] and 0.51% of individuals in a composite African sample.[25]

Following a multifactor hereditary model, Peck et al[5] suggested that transposition of a maxillary canine and first premolar is genetically controlled. This conclusion was reached because of the moderate rate of bilateral occurrence, gender-related differences, increased prevalence of additional dental anomalies as hypodontia, occurrence following a hereditary pattern, and varying prevalence among populations.

When there is transposition of canine and first premolar, the canine is usually displaced in mesiobuccal direction between the first and second premolars, and the first premolar is frequently distally tipped and displaced in a mesiopalatal direction. Moreover, the deciduous canine is often present, yielding a temporary space restriction.[18]

Early diagnosis of a developing transposition is extremely important and has a great influence on prognosis. This may usually be performed by a conventional panoramic radiographic examination when the patient is between 6 and 8 years of age. When the alteration is detected early, interceptive procedures including extraction of deciduous teeth and placement of eruption guides for the permanent teeth may be performed, thus preventing complete development of the anomaly. On the other hand, when transposition is detected at a later stage, orthodontic planning must address the indications for against extraction and the sequence of correcting tooth positioning.

There are more therapeutic options for the maxillary arch compared with the mandibular arch because of the increased potential for orthodontic management in the maxilla. From an esthetic and functional perspective, it is preferable to move the affected tooth into its normal position in the dental arch, especially if transposition affects only the coronal portion of the tooth. In this condition, uprighting and correction of rotation of the affected tooth are commonly required, provided there is enough available space for normal alignment of these teeth.

When transposition is more severe and affects the crown and root, the attempt to reposition affected teeth in the dental arch is complicated and may cause damage to the supporting tissues. Thus, alignment of these teeth in their transposed positions is usually required. The decision to extract a permanent tooth, usually the premolar, is more attractive when teeth affected by transposition present caries or poor periodontal support or when there is a severe tooth-size discrepancy.

When the practitioner decides to reposition the transposed teeth, as in some recent case reports[26–28] and the present one, care should be taken during mechanical management to avoid occlusal interference and root resorption, as well as bone loss, especially of the buccal bone plate. Thus, the palatally displaced premolar should be initially moved to allow free movement of canine on the buccal aspect to its normal position. After repositioning of the canine, the premolar may be corrected. The disadvantage of this approach is the time required for correction, which will be compensated by the esthetic and functional outcome.[4]

CASE REPORT Return to TOC

A girl aged 9 years and 3 months (Figures 1 and 2) presented with the chief complaint of transposition of the maxillary right canine and first premolar. She presented a Class I pattern[29] with good facial relationships, a slightly convex profile, a mixed dentition with a mild Class II malocclusion, and moderate deviation of the maxillary midline. The cephalometric characteristics were normal without clinically significant skeletal deviations. Clinically, the canine was positioned on the buccal aspect in relation to the first premolar. A panoramic radiographic examination revealed that transposition affected the crown and root.

An individualized treatment plan utilizing segmented mechanics was proposed to reposition the ectopic tooth into its normal position

with a reserved prognosis and need of reevaluation.

Treatment was initiated by banding of permanent maxillary first molars with a triple tube on the buccal aspect and a lingual tube for placement of a removable transpalatal arch. Anchorage was achieved by utilization of a passive transpalatal arch and asymmetric cervical headgear used at nighttime to favor correction of the maxillary midline.

After 3 months, a standard edgewise bracket was bonded on the palatal aspect of the maxillary right first premolar (Figure 3) and a segmented 0.019- × 0.025-inch titanium molybdenum alloy (TMA) wire was fabricated with first- and third-order bends for achievement of root movement of the maxillary right first premolar in a palatal direction. The aim of this cantilever was to displace the first premolar outside the alveolar ridge in a palatal direction for achievement of space to allow mesial movement of the canine. This movement was performed with the aid of a passive segment of 0.019- × 0.025-inch rectangular wire and an open coil between the canine and first molar.

At 9 months, the maxillary right second premolar was included in the mechanics (Figure 4) and an open coil was adapted between the maxillary right second premolar and canine for achievement of mesial movement of the canine. The wire segment on the palatal aspect was kept to retain the maxillary right first premolar during this movement and to reduce the risk of contact between the roots of the transposed teeth.

At 11 months, a bracket was bonded on the buccal aspect of the maxillary right first premolar, and distal movement of this tooth was initiated with placement of an open coil between the maxillary right lateral incisor and first premolar. The standard edgewise bracket bonded on the buccal aspect allowed easier torque control during progressive buccal movement of the palatally displaced first premolar. At this stage, the coil used to move the canine was kept inactive.

At 13 months, the anchorage units were removed and the maxillary right central and lateral incisors and maxillary left central and lateral incisors and canines were included in orthodontic mechanics (Figures 5 and 6). At this stage, a stainless steel 0.016-inch wire with an inset bend at the region of the maxillary right first premolar was placed for tooth alignment, partially keeping the palatal position of the maxillary right first premolar. The open coil between the maxillary right first premolar and lateral incisor was kept to promote simultaneous distal movement of the maxillary right first premolar and mesial movement of the maxillary right lateral incisor, with a consequent midline correction. Mesial movement of the maxillary right canine was continued.

At 15 months, it was possible to perform mechanics with a superimposed archwire on the maxillary right canine (Figure 7) for achievement of progressive lingual and buccal movement of the maxillary right canine and first premolar, respectively (Figures 8 and 9). At 26 months, during finalization, it was decided not to perform orthodontic treatment on the mandibular arch because of the favorable occlusal relationship achieved (Figure 10). Also an anomalous conical single root in tooth 47 was observed (11). The treatment objectives and strategic sequence adopted may be better understood by referring to the drawings (a–d) presented in Figure 12.

CONCLUSION Return to TOC

Segmented mechanics was adopted to allow better control of individualized movement of the target teeth, reducing the adverse effects of continuous archwires for correction of transposition. Treatment planning with repositioning of the transposed teeth was selected because of the patient's chronological and dental ages and the absence of a tooth-size discrepancy in the maxillary arch. The total treatment time of 26 months was relatively long yet acceptable considering the absolute correction of the alteration. At treatment completion, the patient presented gingival alterations probably related to the utilization of fixed appliances (Figure 13).

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FIGURES Return to TOC

Click on thumbnail for full-sized image.

Figure 1. Initial extraoral (a, b) and intraoral (c–g) photographs showing Class I facial pattern, Class I molar relationship, and transposition of maxillary right canine and first premolar, both at initial stage of eruption.

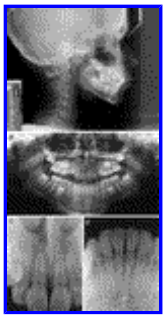

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Figure 2. Initial lateral cephalogram (a) exhibiting normal characteristics, initial panoramic radiograph (b) demonstrating the magnitude of transposition, and periapical radiographs of maxillary and mandibular incisors (c, d) at treatment onset.

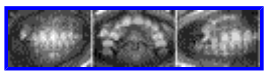

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Figure 3. Intraoral photographs showing archwire segmentation. The utilization of two wires allowed palatal movement of the premolar with simultaneous mesial movement of canine

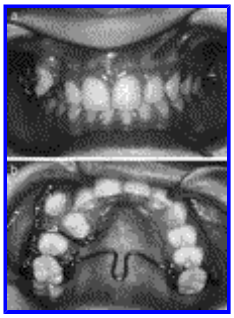

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Figure 4. Ninth month of treatment. Note the wire extension on the mesial aspect of the maxillary right canine (b) to allow its mesial displacement

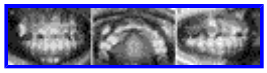

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Figure 5. Photographs at the 13th month. The anterior teeth were included in the mechanics, and an open coil was placed for simultaneous distal movement of first premolar and mesial movement of lateral incisor for midline correction

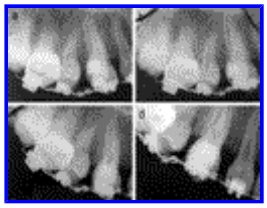

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Figure 6. Follow-up periapical radiographs at the 13th month. Note the superimposition of the maxillary right canine over the root of the maxillary right first premolar.

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Figure 7. At the 15th month, the maxillary right canine was included in the mechanics with a superimposed archwire and inset bend, which was gradually released to allow extrusion

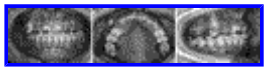

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Figure 8. Midline correction and progressive lingual and buccal movement of maxillary right canine and first premolar, respectively, were performed at the 20th month of treatment

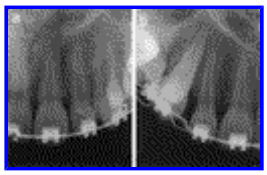

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Figure 9. Follow-up periapical radiographs of maxillary incisors at the 20th month reveal acceptable biological cost in relation to the orthodontic treatment time

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Figure 10. Final photographs with correction of transposition of maxillary right canine and first premolar. Hyperplasia was observed at the maxillary anterior region after 26 months of partial orthodontic mechanics, which encouraged shortening of the remaining treatment time

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Figure 11. The final radiographs show the correction of the transposition, with correct position of canine and first premolar roots. Also, an anomalous conical single root in tooth 47 was observed (b)

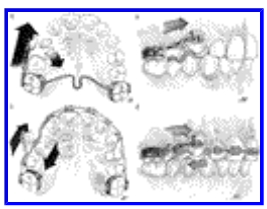

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Figure 12. The drawings (a) and (b) display the objective to displace the maxillary right first premolar (crown and root), achieving alveolar space for mesial movement of the maxillary right canine. Afterward, the maxillary right first premolar was moved in distal and palatal direction (c), whereas the maxillary right canine was moved in mesial direction, revealing the difficult treatment of tooth transposition.

Finally, the corrected transposition is presented (d), only with need of final positioning of the maxillary right canine, with torque control

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Figure 13. Intraoral (a–e) and extraoral (f–k) photographs 2 months after appliance removal. The regression of gingival hyperplasia could be observed

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