Maxillary Canine–First Premolar Transposition - Orthodontic Management
— A Case Report

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Abstract
A case of maxillary canine – first premolar (Mx.C.P,) complete transposition (Bilateral) is presented. In earlier literature most authors advocate to align transposed teeth at the same position, but in this case the teeth were aligned at their natural position. The sequences and orthodontic technique used in this challenging case to align the transposed teeth to their normal position in the dental arch have been described.

Keywords Transposition, Palatal lever arm, Transpalatal arch, Root uprighting spring.

Introduction
Transposition of maxillary teeth is a disturbance of eruptive position, occurring approximately in one out of 300 patients and provides the clinician with a special challenge in diagnostic and therapeutic management. A long needed unifying definition has recently been published: Tooth transposition is the positional interchange of two adjacent teeth, specially their roots, or the development or eruption of a tooth in a position occupied normally by an non-adjacent tooth. Tooth transposition is a designation applied to extreme type of ectopic eruption. All the transpositions are a kind of ectopic eruption but, all the ectopic eruptions may not be teeth transposition. Transposition may be incomplete when the crowns overlap each other but the root apices are in their relative normal position, or complete when both the crown and roots are parallel in their transposed malpositions.

On the basis of anatomic factors, 5 types of maxillary tooth transpositions have been firmly identified. The 5 maxillary transposition types were named and abbreviated according to teeth involved (Fig-1) [Peck & Peck 1995].

1. Canine – first premolar (Mx. C.P.)
2. Canine – Lateral Incisor (Mx. C. I.)
3. Canine – to first Molar site (Mx. C. to M1)
4. Lateral incisor – Central incisor (Mx. I1, I1)
5. Canine to central incisor site (Mx. C to I1)

Etiologic Factors
The Mx. C.P, transposition was recently determined to be an anomaly resulting from genetic influences with a multifactorial inheritance model. Supporting a polygenic cause were finding of elevated frequencies of associated dental anomalies, elevated bilateral
occurrence, familial occurrence, and significant differences in male:female prevalence of the anomaly.

At least 26% cases demonstrated the absence of one or permanent teeth (excluding third molars) in association with the Mx. C.P, transposition anomaly. 27% of the cases shown bilateral expression and 11% had one or more family members known to express the trait. The male:female prevalence rates derived from the available data yielded a sex ratio of M1:F1.55 for Mx. C.P, transposition.

Unlike the other four types of maxillary transposition, there is no evidence that early dentofacial trauma or tooth loss are contributory factors in the causes of Mx. C.P, transposition.

E. M. Miel, a French Dentist, in 1817 was first to describe the Mx. C.P1, transposition anomaly in detail.

Case Report

A 13 years old boy reported to the Orthodontic and Dentofacial Orthopaedic Department, of K.G's University of Dental Sciences, Lucknow with complains of irregular teeth. Clinical examination showed Angle's class-I molar relationship and bilateral canine-1st premolar transposition with bilaterally retained deciduous canine in maxillary arch.

The presented case is the most common type of tooth transposition in humans. Typically in this positional anomaly, the transposed maxillary canines are found blocked out facially between first and second premolars (Fig-2.A & B). The canines were slightly rotated mesiofacially and first premolars were tipped distally and rotated mesiopalatally. Maxillary deciduous canines were present creating a transient arch space deficiency.

Figure 2 A: Pretreatment Intraoral Photograph

Figure 2 B: Pretreatment Occlusal Photograph

Figure 2 C: Pretreatment Periapical Photograph
Figure 2 D: Pretreatment Occlusal Radiograph

Figure 2 E: Pretreatment Panoramic Radiograph

Routine Radiographs, (IOPA, OPG, Occlusal Views) (Fig. 2 C-E) were done to confirm the root positions of affected teeth.

It was noted during the radiographic evaluation that lower left second molar was unerupted and its crown portion was not formed, simulating it to dentogenesis imperfecta type-III.

Treatment Procedures

Aesthetic and occlusal considerations suggested that the alignment of the transposed teeth to their normal positions in the arch is required as alignment in their transposed positions would be esthetically and functionally unacceptable.

In a complete transposition with parallel roots such an attempt could present serious problem of root interference, jeopardizing the vitality of one or both teeth and damaging their supporting structures. Therefore, challenging treatment solutions were required and an unusual approach was used with considerable care and time taken to align the transposed teeth in the normal position in the arch. Standard edgewise mechanics was selected for better tip and torque control. In addition to the labial arch wire, a modified lever arm mechanics was used to torque the roots of premolar palatally. Both first premolars were banded and transpalatal arch were soldered to molars for their stabilization. Upper II\th premolar and molar were stabilized by a 0.019 x 0.025 stainless steel wire in one segment. In the same way a sectional arch wire 0.019 x 0.025 stainless steel was placed on central and lateral incisors after their alignment to consolidate them in a unit.

Treatment mechanics was started to protect the canines at their normal position without extracting deciduous canines, to prevent mesialization of first premolar and preservation of alveolar bone in the region of canine (Fig. 4 A). The same mechanics was applied on both the sides by auxiliary 0.018 x 0.025 stainless steel wire containing an open vertical loop (2 mm x 6 mm). Anterior leg was tied on canine by ligature wire, posterior leg was inserted in molar auxiliary buccal tube by incorporating a step down bend and an open coil spring compressed between mesial to the molar buccal tube and distal leg of vertical loop to create a required protraction force on canine (Fig-3). This force value was up to 75g.

Auxiliary buccal tube

Canine Bracket

Figure 3: Canine protraction assembly containing open coil spring with vertical loop (2mm x 6mm) fabricated by 0.018 x 0.025 S.S. wire.

In the sequence of applied biomechanics the most important task was to cross the root of canine and first premolar. Now at this stage both the premolars and molar tied together by the stainless steel 0.010 ligature wire to prevent mesial tipping of first premolar during their distal root movement on both the side. The palatal root movement of first premolar were not performed before protraction of the crown of the canines to avoid facial crown tipping of first premolar to avoid interferences between them during their movement
(Note: Cingulum of canines were locked in the vicinity of crown of first premolar).

The roots of 1st premolars were torqued palatally by engaging the power chain at the free end of palatal lever arms. Later the power chain were ligated between the end of palatal lever arm and to the palatal arch bar in criss-cross manner to maintain the roots of first premolars palatally and retraction it distally (Fig-4.B).

Finally the alignment and levelling of canines were done by 0.017 x 0.025 Ni-Ti wire. After alignment 0.019 x 0.025 stainless steel wire was placed to torque the roots of canine palatally. The torquing procedure of the canines were not achieved completely at this stage to avoid interference with the roots of first premolars. But this torquing was done to depress the root apices of canine in the cancellous bone to maintain their vitality. Uprighting spring incorporating two open vertical loop (2mm x 6mm) in 0.019 x 0.025 SS wire were ligated. The vertical loops are placed mesial and distal to canine on both the side. The distal leg of anterior vertical loop was 7mm and the mesial leg of posterior vertical is 5mm to achieve up righting of roots of canines. The full dimension wire (0.021 x 0.025) ligated after completion of root up righting, the palatal lever arm with bands were removed and bonding was done on premolars. Individual palatal root torque was incorporated for both the canines.

The first premolar roots were positioned normally due to reciprocal action (labial root torque) because torque is always expressed in reciprocal manner on adjacent teeth.

Finally after root paralleling of canine and first premolar were achieved and the roots of canines were placed in their alveolar housing, a modified kind of Hawley's retainer was placed after removal of orthodontic attachments. The whole treatment time was 2 years and 3 months. Parallelism of roots and healthy adjacent tissue without any damage of root apices of canines can be observed in radiographs (Fig. 5 A-F). The treatment plan for the lower left second molar was placed on wait and watch policy to seek the right time to extract the second molar and align the adjacent wisdom tooth at their place.

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Discussion

The maxillary permanent canine develop under the orbit, above and palatal to the first premolar and lateral incisor. During its long eruptive path, the canine moves labially and mesially and can be palpated high in the labial sulcus. On deviation from the normal eruptive path, the canine may become impacted or may migrate and erupt into position of another tooth. It is for this reason the maxillary canine, more than any other tooth, becomes impacted or transposed. It has been strongly suggested that abnormal pre-eruptive migration, rather than a change in its position at the anlage stage, is the cause of transposition.

It also has been stated that dilacerations and rotation of teeth often result from trauma causing disturbance in the growth of the epithelial sheath of Hertwig during the developmental period of teeth. Therefore, trauma to the deciduous dentition was suggested as the possible cause for transposition in the reported cases with dilacerated teeth adjacent to transposed teeth.

Generally, it is preferable to move teeth to their correct positions in the dental arch. Treatment options in transposition cases include alignment of teeth in their transposed positions, extraction of one or both transposed teeth, or orthodontic movement to their correct positions in the arch.

All factors such as the position of the root apices, esthetic and acceptable occlusion, patient cooperation, and length of treatment time, should be considered in making the treatment decisions. Considerable care and time is required to avoid possible damage to the teeth and supporting structures. Some authors suggest that correction of transposed teeth to their normal positions should not be attempted especially in the lower arch. Alignment in their transposed positions, concomitant with reshaping of their incisal and/or occlusal surfaces, and the use of composite materials for esthetic purposes may be an acceptable compromise.

Acknowledgement

I gratefully acknowledge Dr. Sneh Lata Verma and Dr. Vinay for their valuable contributions.

Communications

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Bibliography