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CASE REPORT

Orthodontic Management of Maxillary Canine-first Premolar Transposition by Unilateral Extraction

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ABSTRACT

Transposition is an extreme and unique form of ectopic eruption. Orthodontic correction of transposed teeth in permanent dentition comprises the following treatment options: teeth alignment in the transposed position, orthodontic tooth movement into correct teeth order, or extraction on one of the transposed teeth followed by orthodontic correction. **Case report:** A 20-years-old male presented severe crowding and dental midline shift on both arches, followed by complete transposition of maxillary left canine – first premolar. A supernumerary tooth was also revealed between maxillary lateral and first premolar on the left side. The patient was treated with a pre-adjusted edgewise fixed appliance system. Extraction of supernumerary tooth and unilateral first premolars on the left side were performed to relieve crowding and to achieve stable occlusion. Improvement of smile aesthetic, correction of midline shift, and also an ideal class I of canine and posterior interdigitation were achieved after 22 months of treatment. **Conclusion:** Definitive treatment of transposition depends on the occlusion, degree of crowding, aesthetics, root position of the transposed teeth, and specific needs of the patient. Care must be taken to prevent midline shift and development of arch asymmetry during orthodontic correction of transposition involving unilateral extraction.

Key words: canine, first premolar, transposition, unilateral extraction

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INTRODUCTION

Tooth transposition is an extreme and unique form of ectopic eruption, which can be observed clinically as a permanent tooth erupts in the position normally occupied by another permanent tooth. The term transposition refers to a position interchange of two adjacent teeth in the same quadrant of the dental arch.¹ Thus, it is a specific type of ectopic eruption in which ectopic tooth would change the normal order of tooth sequence in the dental arch. Tooth transposition is considered as a rare condition, which its prevalence varies from 0.09% to 1.4%.² In general, the distinction can be made between a complete and an incomplete transposition based on the crowns and root structures position of the involved teeth.¹ Furthermore, a classification system with five types on the basis of anatomic factors or the teeth involved has been suggested for maxillary arch, with maxillary canine-premolar transposition (Mx.C.P1) as the most frequent type of tooth transposition.³ Some authors believe the

most accepted etiologic possibility is multifactorial genetic factors⁴⁻⁷, while others consider that the tooth crypt position, supernumerary teeth, or prolonged retention of deciduous teeth may have a role in tooth transposition.^{1,6,8}

Clinical management of transposed teeth comprises interceptive and corrective approach, with interceptive treatment could only be performed if detected early enough, at the age of 6 to 8 years. The choice of orthodontic correction should consider several factors when making the treatment plan including dental morphology, occlusal consideration, facial esthetics, and also treatment time. Orthodontic correction of tooth transposition in permanent dentition consists of the following treatment options: teeth alignment in the transposed position, orthodontic tooth movement into correct teeth order, or extraction on one of the transposed teeth followed by orthodontic correction.⁹ The need for tooth extraction in orthodontic treatment has been discussed since early days and its decision

Figure 1. Pre-treatment records: facial and intraoral photographs

involves more than just the need to obtain space in the arches.¹⁰ In some cases, unilateral extraction will give excellent esthetic results with stable occlusion compared to if the cases had been treated with bilateral extractions. Decision of unilateral extraction of permanent teeth should be based on thorough problem identification and appropriate diagnosis.^{11,12}

This case report demonstrates the successful orthodontic treatment of a patient with the maxillary canine and first premolar (Mx.C.P1) transposition. The patient was treated by unilateral extraction with particular attention to esthetics and function.

CASE REPORT

Case History and Findings

A 20-years-old male patient was referred to our orthodontic clinic and he presented concerned with regard to his crowded anterior teeth, especially on his prominent upper left canine. The pre-treatment facial photograph showed a straight profile with a symmetric

facial pattern (Figure 1). The intraoral examination showed severe anterior crowding on both arches, with appearance of supernumerary tooth between upper left lateral and upper left first premolar. The upper left canine had erupted labially in an ectopic position between the two premolars and it had a 2 mm labial gingival recession. In addition, crossbite was observed on the right canine region. The arch length discrepancies were -9.5 mm (-2.5 mm and -7.5 mm respectively on the right and left side) in the maxillary arch and -9 mm (-2.5 mm and -6.5 mm respectively on the right and left side) in the mandibular arch. He had 2 mm of overjet and overbite. Both upper and lower dental midline were deviated to the right side in relation to facial midline respectively as much as 3.5 mm and 4 mm.

Lateral cephalomeric radiograph (Figure 2) showed a skeletal Class I malocclusion, with maxilla and mandible was positioned slightly anterior relative to Indonesian standards (SNA, 85°; SNB, 83.5°; ANB 1.5°). Panoramic radiograph revealed a complete transposition of the maxillary left canine and the

Figure 2. Pre-treatment records: cephalometric and panoramic radiographs

first premolar with the canine root showing relatively straight structure and parallel to roots of adjacent teeth. Etiologic possibilities for the transposition in this patient included genetic origin and the transposed tooth bud position. Moreover, the patient has a sibling with similar case of transposition (Figure 3).

Treatment Objectives

The treatment objectives were to achieve a functional Class I molar and canine relationship on both sides with good teeth level and alignment, to correct canine crossbite on the right side, to obtain coincident upper and lower dental midline in relation to facial midline, to create normal overjet and overbite with ideal upper and lower incisor inclination, and to correct the transposition. The Mx.C.P1 transposition and severe crowding were corrected by unilateral extraction of first premolars on the left side and also extraction of the supernumerary tooth between upper left lateral and first premolar, without compromising patient profile.

Treatment Progress

The supernumerary tooth and lower left first premolar were first two teeth to be extracted before bracket bonding, while the upper left first premolar was extracted in later stages of treatment. This decision was made as a consequence of the need of dental anchorage to correct maxillary dental midline deviation. A 0.022" pre-adjusted edgewise fixed appliance system with MBT prescription (Ormco Corporation, Glendora, California, USA) was used to treat the case. At initial bracket bonding, some upper and lower anterior teeth were bypassed while upper left first premolar was also bonded (Figure 4). The bypassed teeth were then be engaged in later stages, one tooth after another, each time space was created from the adjacent teeth movement to extraction space, allowing upper and dental midline correction simultaneously.

The upper left first premolar was then extracted in twelve months of treatment, providing space for upper left canine to be included in dental arch. A piggyback method of .016 x .016" stainless steel main archwire for stability and nickel-titanium archwire (gradually changed from diameter of .012" to .016") were then placed in the upper arch to guide upper left canine into correct position. Step-down and step-out bends were made in stainless steel main archwire to allow upper left canine reaching its ideal position uninterrupted. Re-aligning and re-leveling stage was then performed until crowding was resolved. In the finishing phase of treatment, a step-out bend was made on .016 x .022" stainless steel archwire in the left region of dental arch to minimize the effect of unilateral extraction on dental arch asymmetry. It was followed by re-aligning process until .019 x .025" stainless steel archwire was reached. Interarch elastics were also used to obtain ideal intercuspation.

Treatment Result

A bilateral Class I molar and canine relationship with good overbite and overjet values was obtained after 22 months of active orthodontic treatment (Figure 5). Upper left canine was successfully aligned into the dental arch. It still had a slight labial gingival recession from initial state without any progress to more severe condition. Observation for periodontal therapy was indicated to get it treated. Severe anterior crowding on both arches was relieved and the crossbite on right canine region was corrected. Post-treatment facial photographs showed a natural and pleasant smile, with the median lines of occlusion were centered.

The final panoramic radiograph showed acceptable root parallelism (Figure 6). Information on lower third molars impaction was delivered to the patient, but he did not give his consent to get them extracted at the

Figure 3. Clinical comparison between patient (A) and his female sibling (B) showed complete transposition of Mx.C.P1 on same region in both cases. Additionally, case B showed partial transposition of mandibular lateral and canine (Mn.I2.C) on the left side.

Figure 4. Treatment progress records: intraoral photographs

Figure 5. Post-treatment records: facial and intraoral photographs

Figure 6. Post-treatment records: radiographs and cephalometric tracings superimposition (red, before treatment; blue, after treatment).

moment. The patient profile was maintained straight and the cephalometric evaluation showed favorable inclination of maxillary and mandibular incisor (Table 1). The cephalometric superimposition then be made with alignment tracings on the sella-nasion at the sella. Horizontal and vertical skeletal measurements did not show any significant changes from initial condition, while anterior dental parameters showed a reduction of the upper incisor angle and an increase of the lower incisor angle.

DISCUSSION

The maxillary canine-first premolar transposition (Mx.C.P1) is considered as the most frequent type of tooth transposition.^{1, 3} It is frequently accompanied with other dental anomalies including supernumerary teeth that can be found in this case report. Although some studies stated that supernumerary teeth may be related to origin of transposition, but there is no study to elaborate the detailed mechanism yet.^{6, 8} A study by Nelson suggested that the buds for the transposed teeth originated in a transposed position and teeth continued to grow and erupt normally, except in the wrong place.¹³ The study also found that root of transposed canines to be relatively straight as being compared to controls, without any deformation of the roots. The transposed canine in our case is relatively in normal configuration without any sign of dilaceration based on panoramic

radiograph, which suggests the canine bud was already in the transposed position. If the transposition were caused by another developmental disturbance such the supernumerary tooth in our case, the origin of canine tooth bud would be in normal position and after the growth had begun, the tooth would have been moved to its abnormal position, causing the root deformation.

However, there is evidence found in this case report that genetic factors may be the main etiology of the Mx.C.P1 transposition, as is indicated by the existence of same tooth transposition type between the patient and his female sibling. This case report finding supports studies that stated dental transpositions, especially Mx.C.P1, are disturbances of teeth order and eruptive position, resulting from genetic influences within a multifactorial inheritance model. Both genetic and environmental factors may have a role in the etiology of transposition and the relationships between them are complex.^{7, 14, 15}

The orthodontic management of tooth transposition in adult patient has its own challenge for the orthodontists. The decision must be made whether to correct the transposition into normal teeth order, to align the teeth in the transposed position, or to extract one of the transposed teeth.^{3, 9} We decided to correct the Mx.C.P1 transposition in our patient by extracting one of the transposed teeth unilaterally based on some considerations. The best time for correcting

Table 1. Cephalometric measurements

Measurement	Mean	SD	Pre-treatment	Post-treatment
Horizontal Skeletal				
SNA (°)	82	2	85	85
SNB (°)	80	2	83.5	83
ANB (°)	3	2	1.5	2
The Wits (mm)	1	2	2	2
Angle of convexity (°)	0	10	3.5	3.5
Vertical Skeletal				
FMPA (°)	28	4	29	29
SN-palatal plane (°)	8	3	4	4
SN-mandibular plane (°)	32	3	32	32
MMPA (°)	27	4	31	31
LAFH (%)	55	2	56.5	55.67
Anterior Dental				
Interincisal angle (°)	135	10	125	125
U1-palatal plane (°)	109	6	119	115
L1-mandibular plane (°)	93	6	86	90
Soft Tissue				
Upper lip –E Line (mm)	1	2	-1.5	-1
Lower lip – E Line (mm)	0	2	4.5	1.5

the transposition into correct teeth order is, when the cusp tip of the upper canine tooth bud is positioned superior to the root of premolar as described by Peck and Peck.³ The root of first premolar can be tipped distally, allowing the canine to be guided into its correct position. As we can observe in our patient, the upper canine was already in quite similar occlusion level with its adjacent teeth, thus this option may not be suitable to treat this case. The arch length discrepancies in this case were quite severe in both arches, thus it requires premolar extraction to eliminate the dental crowding. The premolar extractions were done unilaterally on both arches since the patient had upper and lower dental midline deviation. If the case had been treated by bilateral extraction, it would be a challenge on orthodontic mechanics to center the dental midlines facially. Furthermore, it would impair the patient's facial profile, which was already straight. By unilateral extraction, the treatment would require less time without compromising smile esthetics and functional occlusion of the patient.

Despite the benefit that unilateral extraction could give to this case, care must be taken to prevent any unwanted effects during such treatment method. Some studies concluded that unilateral extraction on maxillary arch generally results in a narrower or flattened arch form, with the lateral incisor and canine tooth positions

being located more palatally on the extraction side. Additionally, there is a tendency for deviation of the maxillary midline toward the extraction side of the arch.^{16, 17} Our case showed there is no sign of deviated midline occur on both upper and lower arch in the end of treatment. On the other hand, there is a slight degree of asymmetry on arch form, which is measured by method as described by Struths.¹⁷ Upper lateral and canine in extraction side are located consecutively 0.5 mm and 0.7 mm more palatally than the same teeth in the non-extraction side. Similar condition also can be found on the mandible with lower canine in extraction side is located 0.5 mm more lingually than the canine in non-extraction side. However, the difference was small and can be considered clinically insignificant. Regardless of the side effects that may present in unilateral extraction treatment, it should still be considered as an option when it is practical and beneficial to treat a case, such as tooth transposition. Appropriate diagnosis and mechanics should be carried out, with caution against deviated midline or excess collapse of the arch.

CONCLUSION

Management of tooth transposition will always be a certain challenge for orthodontists. Definitive

treatment of such condition depends on the occlusion, degree of crowding, aesthetics, root position of the transposed teeth, and specific needs of the patient. Care must be taken to prevent midline shift and excessive development of arch asymmetry during orthodontic correction of transposition involving unilateral extraction.

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