

Unusual orthodontic approach to a maxillary canine-premolar transposition and a missing lateral incisor with long-term follow-up

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In this case report, we present an unusual approach that was used to treat a 14-year-old patient with a bilateral canine-premolar transposition and a missing maxillary lateral incisor. The orthodontic treatment involved maintaining the transposition and creating a space for lateral incisor replacement. Toward the end of the treatment, accentuated buccal root torque was performed, and lateral group function was established to improve the treatment outcome. Finally, an ideal esthetic and functional occlusion was achieved. The 8-year posttreatment follow-up records show the stability of this treatment. (Am J Orthod Dentofacial Orthop 2012;142:690-7)

T ooth transposition is a relatively rare condition in which a permanent tooth develops and erupts in a position normally occupied by another permanent tooth.¹⁻⁶ Maxillary canine-premolar transposition is the most frequent type of tooth transposition, and several theories have been proposed to explain this condition. Genetic origin,^{2,4-9} prolonged retention of deciduous teeth, supernumerary teeth, and local pathologic processes are some reported causes.^{3,6-8,10}

Transpositions in the mixed dentition are usually corrected when the dentoalveolar process has adequate width, the canine involved in the transposition has not completely erupted, and the transposition is not yet completed.^{1,11-13} However, when the teeth involved have fully erupted and are almost aligned, and the dentoalveolar process is narrow, a satisfactory result can be obtained by maintaining the transposed teeth, preventing root resorption and gingival recession, and avoiding prolonged orthodontic treatment.¹²⁻¹⁴

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Copyright © 2012 by the American Association of Orthodontists. http://dx.doi.org/10.1016/j.ajodo.2011.03.027 Here, we present a patient with bilateral maxillary canine-premolar transposition and a missing maxillary lateral incisor, who was treated by maintaining the transposed tooth positions with particular attention to function and esthetics. We also present the long-term follow-up findings.

DIAGNOSIS AND ETIOLOGY

A healthy 14-year-old girl came to us with her parents for the treatment of crowding of the teeth in both arches and the absent maxillary right permanent lateral incisor and left permanent canine. She had a straight profile and symmetric facial development (Fig 1). The intraoral clinical examination showed an Angle Class II malocclusion with left subdivision. We observed prolonged retention of both maxillary deciduous canines, absence of the right lateral incisor, and complete transposition of the right permanent canine with the first premolar. In addition, a unilateral posterior crossbite on the left side was observed (Fig 2).

The radiographic examination showed complete transposition on the right side and impaction of the maxillary left permanent canine with accentuated mesial inclination and incomplete transposition with the first premolar. Moreover, the absence of the maxillary right lateral incisor was confirmed (Fig 3). Cephalometrically, she had a good facial pattern with the mandibular incisors in a good position and the maxillary incisors slightly retroclined (Fig 4; Table).

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Fig 1. Pretreatment facial and intraoral photographs.

TREATMENT OBJECTIVES

The treatment objectives for this patient were to (1) correct the posterior crossbite on the left side, (2) establish a Class 1 molar relationship on the left side, (3) extract the maxillary deciduous teeth, (4) maintain the maxillary canine-premolar transposition on the right side and perform a prosthetic replacement of the permanent lateral incisor, (5) move the impacted canine on the left side while maintaining the transposition, and (6) establish ideal overbite, overjet, and adequate occlusion with group function in lateral excursion.

TREATMENT ALTERNATIVES

Three treatment options were available for this patient. The first was corrective positioning of the transposed teeth to their normal positions in the arch. However, the dentoalveolar width was too narrow to permit the movement of these 2 teeth through the bone, so this treatment option was rejected. The second option was extraction of the maxillary first premolars to establish Class I canine and Class II molar relationships; this option was also discarded, because the maxillary left permanent canine was positioned in an accentuated distal position and would require orthodontic movement over a large area to establish the Class I relationship.

The third option considered was to maintain the transposition, moving the right first premolar to the position of the lateral incisor on the right side to achieve a Class I relationship and, on the left side, leaving the premolar in the position of the canine. This alternative was considered esthetically harmful, because of the change it would cause in the gingival contour and tooth shape and color. Moreover, after the treatment, the



Fig 2. Pretreatment dental casts.

lateral function on the right side would be canine disclusion, whereas on the left side it would be group function.

TREATMENT PROGRESS

Initially, bonded buttons were placed on the lingual surfaces of the maxillary left second premolar and first molar and on the buccal surfaces of the mandibular left second premolar and first molar. Subsequently, elastics were used over 2 months to correct the crossbite. In the third month, a standard edgewise appliance, 0.022 imes 0.028 in, was bonded on the mandibular arch. In the following months, the teeth in the maxillary arch were sequentially bonded, and the deciduous teeth were extracted to permit appropriate aligning and leveling of the arch. To provide adequate area for this, both maxillary canines were not bonded during the initial period, when the first premolars were moved toward the mesial aspect. On the left side, the first premolar was moved until it established contact with the lateral incisor, and then the canine naturally occupied a favorable position in the arch, as seen in the radiographs (Fig 5).

In addition, a coil spring was used between the first and second premolars to widen the space,



Fig 3. Pretreatment radiographs.



Fig 4. Pretreatment cephalogram and tracing.

and elastomeric chains were used between the central or lateral incisor and the first premolars to improve the anterior movement. To maintain the space for prosthetic replacement, a compressed coil spring was also placed between the right central incisor and first premolar. Toward the end of the treatment, a 0.021 \times 0.025-in stainless steel archwire was inserted to establish optimal torque of the anterior teeth. For the first premolars, accentuated buccal torque was used to the roots to simulate canine prominence and give the required support to the lips.

Accentuated lingual torque of the canine roots was used to prevent too much prominence on both sides. Vertical elastics were used for the subsequent 2 months to improve intercuspation of the teeth, and then the appliances were removed. A circumferential maxillary retainer with a provisional right lateral incisor was used in the maxillary arch, whereas a bonded canine-to-canine retainer was placed in the mandibular arch.

TREATMENT RESULTS

The facial pattern was maintained (Fig 6), and the treatment provided the following outcomes: Class I molar relationships on both sides, maxillary first premolars performing the function of the canines in a Class I relationship with the mandibular canines, and adequate

Measurement	Norm	Pretreatment*	$Posttreatment^{\dagger}$
SNA (°)	82	83	81
SNB (°)	80	78	78
ANB (°)	2	5	3
Mx1.NA (°)	22	19	24
Mx1-NA (mm)	5	5	6
Md1.NB (°)	25	25	24
Md1-NB (mm)	5	7	6
Mx1.Md1 (°)	131	133	130
SN.GoGn (°)	32	29	29
FMA (°)	25	21	22
FMIA (°)	60	62	62
1MPA (°)	95	97	96
Upper lip-S line (mm)	0	0	-2
Lower lip-S line (mm)	0	1	-2

Table. Cephalometric summary

*Pretreatment records at age 14 years 2 months; [†]Posttreatment records at age 17 years 9 months.

overbite and overjet. Lateral group function was established to prevent overload on the first premolars. The maxillary and mandibular midlines remained mismatched even at the end of treatment, with a 1.0-mm deviation between them, and a space of 0.5 mm remained between the left lateral incisor and the first premolar; this was filled with composite resin after the retention period.

The lateral incisor space was restored with a bonded restoration, because the patient was too



Fig 5. Periapical radiographs of the maxillary left side during treatment: **A**, while the first premolar was being moved anteriorly; **B**, after opening of the space, the canine started the extrusion and occupied a better position in the arch.



Fig 6. Posttreatment facial and intraoral photographs.

young to receive an implant immediately after orthodontic treatment (Fig 7). The posttreatment panoramic radiograph showed good parallelism of the roots and no root resorption. An accentuated root curvature of the left first premolar root could be seen (Fig 8). Cephalometrically, the patient had



Fig 7. Posttreatment dental casts.

a similar pattern as in the beginning of the treatment as seen in the final cephalogram and the superimposition (Figs 9 and 10). The 8-year posttreatment (6 years postretention) records showed that the occlusion remained stable over the years, and that the conditions of the hard and soft tissues were also maintained (Fig 11).

DISCUSSION

Maxillary canine-premolar transposition is the most frequent type of transposition treated by orthodontists^{2,4-9} and is frequently associated with other dental anomalies such as absence of teeth, as seen in this patient.^{9,13,15} The etiologic factors for transposition are variable; in this patient, the cause probably was the prolonged retention of the deciduous teeth, which is considered one of the most common causes for transpositions.^{4,6,8,10}

There are several treatment options available for canine-premolar transpositions that might or might not involve extraction of permanent teeth.^{2,7,10,11,14} In the nonextraction treatment option with narrow dentoalveolar bone, it is preferable to maintain the transposition, because attempts to restore the normal tooth positions could lead to a prolonged treatment period along with irreversible



Fig 8. Posttreatment radiograph.

consequences such as root resorption and gingival recession.^{1,7,13,16}

The orthodontic treatment option of maintaining the canine-premolar transposition has limitations with respect to esthetic and functional rehabilitation.^{3,14,16} There are differences in size, shape, and color between the teeth involved, and this can occasionally create esthetic problems with the patient's smile.^{3,10,16} Furthermore, the gingival margin of the premolar is positioned more occlusally relative to the canine. Therefore, it could require gingival recontouring after treatment, or extrusion of the canine and equilibration of the cusp. In our



Fig 9. Posttreatment cephalogram and tracing.

patient, the amount of equilibration would have been too extensive if the canines were extruded, so we preferred gingival surgery. However, the patient and her parents believed that periodontal surgery was not necessary. Therefore, the gingival level discrepancy remained and affected the overall esthetics.

In our patient, stripping was performed on the mesial and distal surfaces of the canines to reduce the mesiodistal width and to achieve a better functional relationship with the mandibular canine.¹⁷ Another important issue to be considered was the interference between the palatal cusps of the transposed premolar and the mandibular canine that normally occurs in transpositions.¹⁶ However, in our patient, an accentuated buccal root torque was accomplished; consequently, lateral group function was established. Thereafter, no interference was observed between the cusps at the end of treatment, and reshaping was not necessary.

CONCLUSIONS

Such unusual treatment should be accompanied by long-term follow-up to observe the stability and the condition of the occlusion. In our patient, the reevaluation conducted 8 years after treatment and 6 years after retention showed an optimal functional occlusion with good stability of the tooth positions.



Fig 10. Overall superimposition of the initial and final cephalometric tracings on the sella-nasion line at sella.

This type of treatment is not the conventional protocol for tooth transpositions. The appropriate treatment should be selected only after careful diagnosis, which can vary from patient to patient.



Fig 11. Facial and intraoral photographs 8 years after the end of treatment (6 years postretention).

REFERENCES

- Bocchieri A, Braga G. Correction of a bilateral maxillary caninefirst premolar transposition in the late mixed dentition. Am J Orthod Dentofacial Orthop 2002;121:120-8.
- 2. Halazonetis DJ. Horizontally impacted maxillary premolar and bilateral canine transposition. Am J Orthod Dentofacial Orthop 2009;135:380-9.
- Maia FA, Maia NG. Unusual orthodontic correction of bilateral maxillary canine-first premolar transposition. Angle Orthod 2005;75:266-76.
- 4. Peck S, Peck L. Classification of maxillary tooth transpositions. Am J Orthod Dentofacial Orthop 1995;107:505-17.
- Peck S, Peck L, Kataja M. Concomitant occurrence of canine malposition and tooth agenesis: evidence of orofacial genetic fields. Am J Orthod Dentofacial Orthop 2002;122:657-60.
- Shapira Y, Kuftinec MM. Maxillary tooth transpositions: characteristic features and accompanying dental anomalies. Am J Orthod Dentofacial Orthop 2001;119:127-34.
- Babacan H, Kiliç B, Biçakçi A. Maxillary canine-first premolar transposition in the permanent dentition. Angle Orthod 2008; 78:954-60.
- Camilleri S. Maxillary canine anomalies and tooth agenesis. Eur J Orthod 2005;27:450-6.

- Türkkahraman H, Sayin MO, Yilmaz HH. Maxillary canine transposition to incisor site: a rare condition. Angle Orthod 2005;75:284-7.
- Ciarlantini R, Melsen B. Maxillary tooth transposition: correct or accept? Am J Orthod Dentofacial Orthop 2007;132:385-94.
- Asensi JC. Mixed unilateral transposition of a maxillary canine, central incisor, and lateral incisor. Am J Orthod Dentofacial Orthop 2010;137(Suppl):S141-53.
- 12. Parker WS. Transposed premolars, canines and lateral incisors. Am J Orthod Dentofacial Orthop 1990;97:431-48.
- Sato K, Yokozeki M, Takagi T, Moriyama K. An orthodontic case of transposition of the upper right canine and first premolar. Angle Orthod 2002;72:275-8.
- 14. Kuroda S, Kuroda Y. Nonextraction treatment of upper caninepremolar transposition in an adult patient. Angle Orthod 2005; 75:472-7.
- Ruellas ACO, de Oliveira AM, Pithon MM. Transposition of a canine to the extraction site of a dilacerated maxillary central incisor. Am J Orthod Dentofacial Orthop 2009;135(Suppl):S133-9.
- Vitale C, Militi A, Portelli M, Cordasco G, Matarese G. Maxillary canine-first premolar transposition in the permanent dentition. J Clin Orthod 2009;43:517-23.
- Bruno MB, Barraso Salomão M, Vilella Ode V, Mucha JN. A new spring for correction of maxillary canine-premolar transposition. J Clin Orthod 2008;42:303-7.