Orthodontic Correction of Impacted and Transposed Upper Canines

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The canines have the highest reported incidence of dental transposition—most commonly with the first premolar, followed by the lateral incisor.1-8 Several authors have described cases in which canine transpositions were resolved or the teeth were aligned in their transposed positions.9-11 To our knowledge, however, no one has reported treating a patient in whom bilaterally impacted upper canines were transposed with the lateral incisors and were also associated with severe root resorption of adjacent teeth.

Canine transposition is one of the most common causes of tooth resorption. Typically, an upper lateral-incisor root is affected by ectopic eruption of the adjacent canine, although central incisors can also be involved.12 The apical and middle thirds of the incisor roots are most likely to be resorbed.

In cases of severe root resorption, the risk of losing the incisor should be considered when planning treatment of the impacted canine. Extraction of the severely resorbed lateral incisor may be a better option than removal of the canine, especially when there is insufficient space for prosthetic replacement. On the other hand, one study found that removing the source of pressure resorption from an impacted upper canine could improve the long-term stability of the adjacent resorbed teeth.13
Two different treatment approaches were used in the case shown here.

**Diagnosis and Treatment Planning**

A 14-year-old male patient presented with the chief complaint of missing upper canines and a mobile left lateral incisor. The patient’s deciduous canines had not exfoliated until age 13. Clinical examination showed a slightly concave profile, a normal mentolabial sulcus, and a prominent soft-tissue pogonion (Fig. 1). The patient had a Class I malocclusion with normal overbite and overjet, and the mandibular dental midline was deviated 2mm to the right of the maxillary dental and facial midlines. Both upper permanent canines were absent,
would entail a slow and complicated treatment. They accepted these risks.

Treatment Progress

After extraction of the upper left lateral incisor, a fixed appliance was bonded in the upper arch. Periodontal surgery exposed the upper left canine, and the crown was bonded with an attachment. A lingual hook was bonded to the impacted upper right canine for traction. Pre-adjusted edgewise brackets were bonded to the maxillary teeth, and an .018” Australian wire was applied to level the arch while allowing the right lateral incisor to drift distally. The space between the right central and lateral incisors would then be sufficient for eruption of the upper right canine.

After four months of treatment, the upper left canine had been brought into the arch, but the right canine had still not emerged. Two months later, the right canine erupted with a 90° mesial rotation. An attachment was bonded to the crown, and a helical loop was added to the upper archwire for traction and rotation correction of the right canine (Fig. 2). After 11 months of treatment, a couple was applied between the upper right and left canines for further correction of the right-canine rotation; an auxiliary .014” nickel titanium archwire was also used, along with triangular elastics from the upper right canine to the lower right lateral incisor and lower right canine.

After 16 months of treatment, once the upper left canine, right lateral incisor, and right canine had reached satisfactory positions, the maxillary arch was further leveled and aligned with an .018” x .025” stainless steel wire (Fig. 3). A 2mm diastema between the right lateral incisor and canine was closed with power chain and light Class III elastics. Mandibular leveling and alignment were carried out with a sequence of .014”, .016”, and .018” nickel titanium archwires, followed by .017” x .022” and .018” x .025” stainless steel archwires.

After 27 months of orthodontic treatment, the fixed appliances were removed. An upper Hawley retainer, with an acrylic pontic in the left-canine position, and a lower circumferential retainer were delivered. Space was left between the upper left canine and first premolar for an implant or prosthesis to be placed after the completion of growth.

Treatment Results

A bilateral Class I molar relationship was achieved, with good occlusion, ideal overbite and overjet, a straight profile, and an esthetic smile (Fig. 4). Final radiographs indicated intact roots, proper root alignment, and no root resorption except for the central incisors. The mobility of the upper right central incisor was acceptable during and after treatment, and the tooth showed no apparent increase in root resorption.

Two years after treatment, the occlusion had remained sta-

Orthodontic Correction of Impacted and Transposed Upper Canines

ble. The upper right central incisor was eventually lost due to trauma and replaced with an implant (Fig. 5).

Discussion

The etiology of transposed impacted canines—which may involve genetic factors,\textsuperscript{2,14,15} interchanged positions of the developing tooth buds,\textsuperscript{16,17} failure of deciduous-canine root resorption, or mechanical interferences to permanent-canine eruption\textsuperscript{16,18}—is still controversial and not completely understood.\textsuperscript{6} In our patient, whose deciduous canines did not exfoliate until he was 13 years old, the bilateral transposition of impacted canines was most likely caused by the retained

Fig. 4 A. Patient after 27 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.
Orthodontic Correction of Impacted and Transposed Upper Canines

Fig. 5 Patient two years after completion of treatment, showing proper canine and molar relationships and implant replacements of upper right central incisor and left canine.
deciduous teeth and a transposition of the canine buds.

The literature indicates three main options for treatment of dental transpositions: extraction of one of the transposed teeth, alignment of the teeth in the transposed positions, or orthodontic movement of the teeth to their normal positions. Esthetically and functionally, the last is the treatment of choice. It does, however, carry the risk of root interference, which can lead to root resorption and thinning of the labial alveolus and mucosa—possibly resulting in clefting or recession of the gingiva, especially when it is inflamed.

Our patient exhibited two-thirds root resorption and Class II mobility of the upper left lateral incisor, indicating severe root resorption according to the classification of Ericson and Kurol. Because of the risk of losing the tooth after orthodontic movement, the decision was made to extract the upper left lateral incisor and move the canine into the incisor position. Although this approach rapidly brought the canine into the arch, it did require the extraction of a permanent tooth that eventually needed prosthetic restoration.

Canine substitution is esthetically challenging because of the differences in size, shape, and shade between the upper canines and lateral incisors. In the case shown here, the canine bracket was inverted and positioned more gingivally to increase palatal root torque and extrude the canine and its gingival margin, thus reducing the canine eminence and tip. Since the canine is wider than the lateral incisor, it was narrowed by interproximal enamel reduction after treatment.

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REFERENCES