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# Orthodontic and Periodontal Management of Canine-Premolar Transposition in the Maxilla Complicated by Recession

**Abstract:** Tooth transposition is the positional interchange of two adjacent teeth or the development or eruption of a tooth in a position occupied normally by a non-adjacent tooth. It has a reported incidence of 0.4% of the population and is more common in females. Canine-premolar transposition is the most common presentation, occurring more frequently in the maxilla.<sup>2</sup> A 17-year-old female presented with an unerupted left maxillary canine in complete transposition with the maxillary left first premolar. Orthodontic treatment to correct the malocclusion and the transposition was complicated by gingival recession, which in turn was treated with corrective periodontal surgery.

**Clinical Relevance:** This case report demonstrates the risk of localized gingival recession in the orthodontic management of canine-premolar transposition cases, even when opting for a less hazardous treatment plan. Most importantly, it highlights the importance of an interdisciplinary approach to patient care.

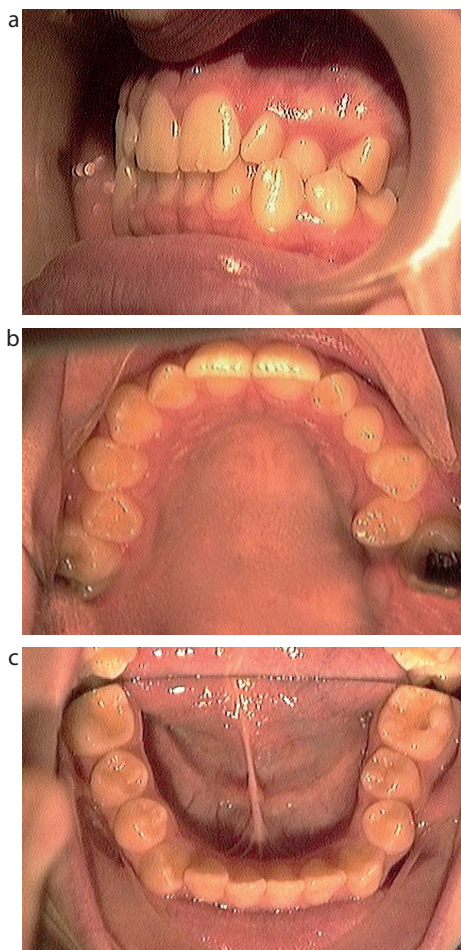
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Tooth transposition is the positional interchange of two adjacent teeth or the development or eruption of a tooth in a position occupied normally by a non-adjacent tooth.<sup>1</sup> The aetiology is complex, with both genetic and environmental factors playing a role.<sup>2</sup> Tooth transposition, which is considered to be a sub-division of ectopic eruption, can be either complete or incomplete. Complete transposition is where the crown and the

root are transposed, whereas incomplete transposition refers to where the crown is transposed but not the root apex.<sup>3</sup> It occurs in 1 in 300 orthodontic patients or 0.4% of the population. It is more common in females and canine-premolar transposition is the most common presentation. Transposition occurs more frequently in the maxilla, usually unilaterally and on the left side.<sup>4</sup>

Gingival recession is defined as the apical migration of the junctional epithelium with exposure of the root surface.<sup>5</sup> It presents both aesthetic and functional problems that may require treatment and can arise as a complication during or after orthodontic treatment.

The following case report describes the orthodontic and periodontal management of a patient with complete



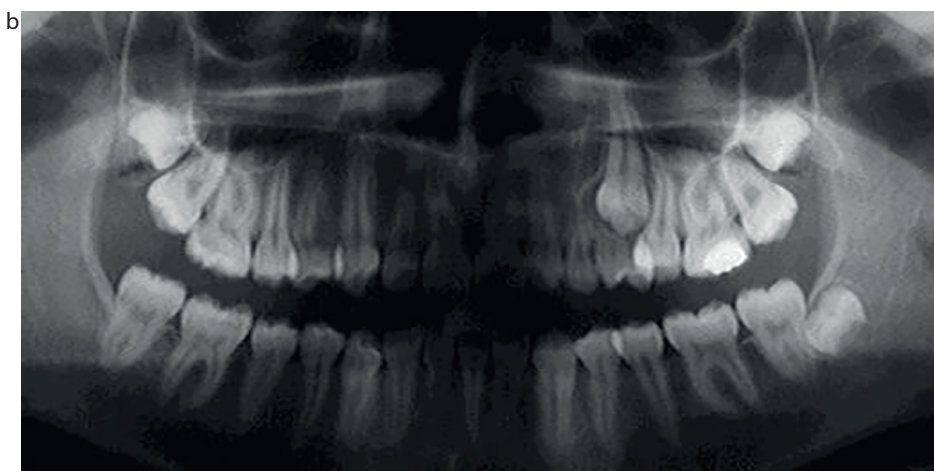
**Figure 1.** (a–c) Pre treatment intra-oral views.

transposition of the left maxillary canine and premolar complicated by recession during orthodontic treatment.

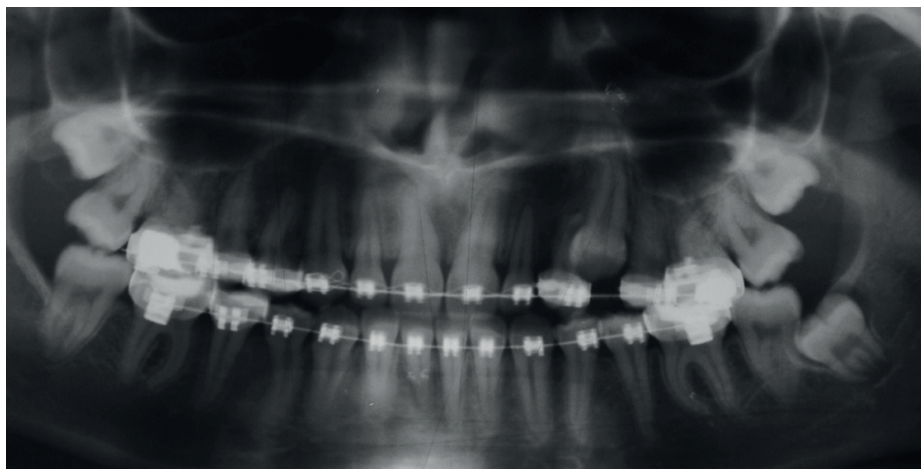
### Case presentation

A 17-year-old girl presented with a Class I malocclusion on a Skeletal III dental base relationship and competent lips. Vertically her facial proportions were correct and transversely there were no asymmetries present. The profile was slightly concave.

Intra-orally the upper arch was mildly crowded with both left and right lateral incisors rotated. The upper incisors were mildly retroclined and the upper left deciduous canine was still present and in contact with the mesio-labially rotated first premolar. The upper left second premolar was palatally displaced and, to a lesser extent, the upper right second premolar. The upper left lateral incisor was slightly narrower in its mesio-distal dimension than its antimere (Figure 1). The lower arch was mildly crowded with mild incisor retroclination and rotations present at both lower permanent canines. Occlusal caries was noted in the lower left first molar.



**Figure 2.** (a) Pre-treatment lateral cephalogram. (b) Pre-treatment panoramic view.



**Figure 3.** Progress panoramic view showing space being created to allow transposed canine to erupt.



In occlusion, the overbite was normal and complete and the overjet was normal. A bilateral buccal crossbite and an anterior crossbite were present.

Radiographically, the cephalometric findings showed a mild Skeletal III pattern and the OPG revealed an unerupted left maxillary canine in total transposition with the first premolar. The lower right third molar was agenetic and the remaining third molars were unerupted (Figure 2).

**Treatment plan**

1. Extract the upper left deciduous canine;
2. Place upper and lower fixed appliances with the following aims:
  - Correct incisor inclination and angulation;

- Correct alignment and rotations;
  - Correct anterior and posterior crossbites;
  - De-rotate and position the maxillary left first premolar mesially into the canine position accepting the permanent canine in the transposed position;
  - Accept slightly narrower left-sided lateral incisor.
3. Retain.

**Orthodontic treatment**

Lower fixed appliances using a pre-adjusted edgewise 0.022"/0.028" system were placed. A transpalatal bar was placed in the upper arch to expand and de-rotate the upper first molars and the upper fixed

appliances were placed four months later. Initial alignment and rotational correction was carried out using 0.014" nickel titanium archwires and, as the case progressed, upper and lower 0.016" and 0.018" nickel titanium archwires were used to complete the alignment. Steel ligatures were placed on the lower canines and the upper left first premolar in combination with elastic chain between the buccal aspect of the transposed first premolar and the first molar to correct the rotation. Open coil spring was placed between the left-sided premolars to move the upper left first premolar mesially and open up space to allow the canine to erupt (Figure 3). An upper working archwire of 0.018" x 0.025" nickel titanium, in combination with a lower 0.018" nickel titanium, was used to move the upper first premolar to its eventual position, as well as close any remaining spaces (Figure 4). The transposed canine was bonded and traction placed with a piggy-back 0.014" nickel titanium archwire, while the working



Figure 4. (a, b) Upper 0.018" x 0.025" and lower 0.018" nickel titanium wires in place.



Figure 5. Post-orthodontic panoramic.



Figure 6. Intra-oral view showing Miller's Class 1 (4 mm gingival recession defect) at transposed upper left first premolar.

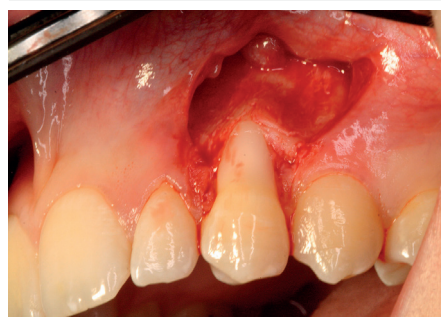


Figure 7. Intra-oral image of the raised gingival flap.

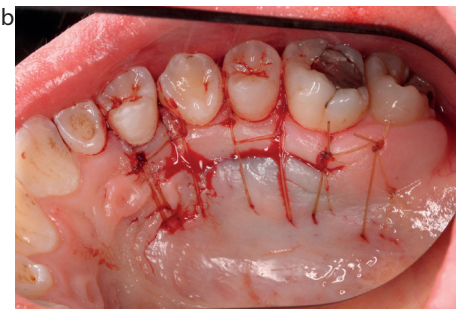


Figure 8. Intra-oral views of (a) a harvested connective graft and (b) a palatal wound closure using chromic sutures.

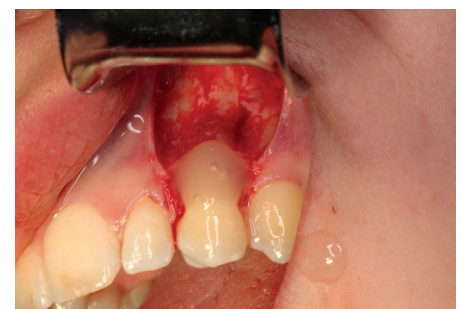
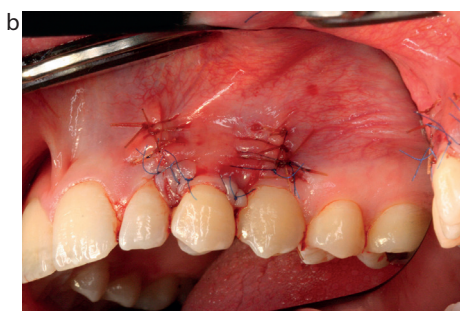
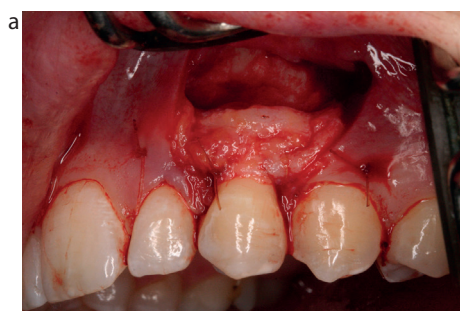


Figure 9 Intra-oral view of EMD Emdogain (Straumann®) applied to the root surface.





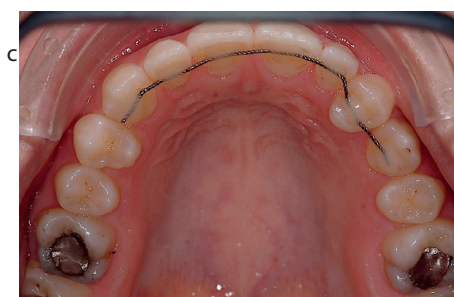
**Figure 10.** Intra-oral views of (a) a connective tissue graft sutured in place and (b) a coronally advanced flap sutured over connective tissue graft.



**Figure 11.** Intra-oral views of graft (a) 1 month post-surgery and (b) 4 months post-surgery.

0.018" x 0.025" nickel titanium archwire with coil spring maintained and increased the space for the erupting canine. Once the canine was extruded fully, elastic chain was used to close any remaining space accepting the narrower left lateral maxillary incisor.

During space opening and mesial movement of the upper first premolar, gingival recession on the buccal aspect of this tooth was noted. This was monitored carefully as treatment progressed. Aesthetically, the shape and size



**Figure 12.** Final orthodontic extra-oral and intra-oral views one year post periodontal surgery.

of the transposed premolar was acceptable in the canine position and did not require any aesthetic modification. On completion of treatment, upper and lower clear Essix-type retainers were fitted. The facial profile and occlusion was satisfactory and the OPG showed good root parallelism, including the canine-premolar region (Figure 5).

Marked gingival recession of 4 mm confined to the attached gingivae (Miller's Class 1 defect) was noted on the buccal aspect of the upper left transposed first premolar and periodontal advice and treatment was advised (Figure 6). The patient was referred to a periodontist who advocated the use of a coronally advanced flap (CAF) in combination with the use of enamel matrix derivative (EMD) and also a connective tissue graft (CTG). The latter was advised because of the very thin gingival biotype in this case.

### Periodontal treatment

The patient was given appropriate

analgesia and oral antibiotics pre-operatively. Local anaesthetic was administered. A flap was raised and the dental papillae were de-epithelialized on their facial surface and an odontoplasty performed to flatten the profile of the buccal surface of the root slightly (Figure 7). A strip of connective tissue was harvested from the left side of the palate and the wound was closed with primary closure using 4-0/5-0 chromic sutures (Figure 8).

EDTA gel was applied to the root surface for two minutes to clean and etch the root. This was carefully washed off with saline and enamel matrix derivative EMD Emdogain (Straumann®) was applied to the root surface for 60 seconds (Figure 9). The CTG was placed over the EMD treated root and sutured into position. A CAF was sutured over the connective tissue graft with both simple and sling sutures using 6-0 polypropylene and 5-0 chromic sutures (Figure 10). Post-operative instructions were given.

The patient had periodontal follow-up at two weeks for suture removal and 4 months later for review (Figure 11). The recession defect was corrected from both a functional and aesthetic perspective. The upper clear retainer was replaced with a fixed bonded retainer and a post retention orthodontic follow-up at one year was satisfactory (Figure 12).

### Discussion

There are usually three treatment possibilities in canine-premolar transposition type cases.

Firstly, the transposed tooth may be extracted in severely crowded cases. However, accepting the transposed position of the canine is the most common approach with fewer treatment risks. Premolar morphology in particular, cusp shape and size, tooth colour, root prominence, gingival levels and the possibility of cusp reshaping by grinding or restoration must be considered if this option is chosen.<sup>6</sup> In this case, along with the aforementioned variables, the facial profile, the degree of crowding, the presence of the left-sided retained deciduous canine, the position of the totally transposed canine and insufficient bucco-palatal width, led to accepting the transposed order of the teeth.

Finally, restoring the natural tooth order is a possibility and may be more suitable when treatments are commenced in the mixed dentition. Usually it is more technically challenging and with a higher risk of gingival recession and bone loss, longer treatment time and possible root resorption.<sup>6</sup>

In this case, an unexpected complication of significant gingival recession occurred even though we opted for the safest and most predictable treatment plan.

The aetiology of gingival

recession is multifactorial and may include orthodontic tooth movements. In general, patients with gingival recession are mainly concerned about poor aesthetics, dentine sensitivity and poor plaque control.<sup>7</sup> This patient's chief complaint was the unsightly appearance of the localized area of recession which required periodontal surgery with minimal operative and post-operative risks.

In the treatment of gingival recession, much of the current literature suggests that only CTGs in combination with CAFs appear to be consistently effective over time, especially in terms of root coverage.<sup>8</sup> Objective evidence suggests that healing occurs through a long junctional epithelium or close adaptation of connective tissue with adjacent root surface, with only limited ability to regenerate missing cementum.<sup>7</sup>

In an effort to effect true periodontal regeneration, enamel matrix proteins or their derivatives, which are responsible for the development of cementum and periodontal ligament in tooth development, can be used in the treatment of recession defects. When an EMD, such as Emdogain (Straumann®) is applied to a cleaned root surface, a rise in temperature and pH takes place and EMD forms an extracellular matrix on the root surface. This in turn influences cell attachment and mediates the formation of cementum on the root, providing a foundation for all necessary tissues associated with a true functional attachment.<sup>9</sup>

Based on the results of a ten year

follow-up investigation, treatment results with either EMD and CAFs or CTGs and CAFs were similar on all measured parameters for the treatment of mild to moderate gingival recession defects.<sup>7</sup> Considering the morbidity of harvesting connective tissue from the palate, the above findings are welcome.

## Conclusion

Successful treatment of transposition depends on a detailed orthodontic and periodontal diagnosis, correctly timed treatment and knowledge of potential risks and how to manage them. In this case, orthodontic treatment was complicated by gingival recession, which was successfully managed by corrective periodontal surgery to attain a satisfactory outcome.

## Acknowledgements

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