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Impossible canines?

Abstract: A transposed tooth is one which is changed in positional location to an adjacent tooth, or one which is erupting in a position normally occupied by a non-adjacent tooth. This article is a series of case reports demonstrating correction of transposed canines, including impacted canines in cases of high difficulty levels.

Clinical Relevance: This paper demonstrates that even the most severely transposed/impacted teeth can be corrected, using modified auxiliaries to fixed appliances.

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A transposed tooth is defined as one which is changed in positional location to an adjacent tooth or one which is erupting into a position normally occupied by a non-adjacent tooth.¹ According to Peck and Peck, the most commonly affected tooth is the maxillary canine, which is frequently transposed with the first premolar or the lateral incisor.² This type of transposition is more common in females than in males and it is claimed to have a genetic aetiology with a polygenic inheritance pattern.

Treatment options for canine premolar transpositions range from acceptance of the transposition to complete or partial correction of the same. In some cases, interceptive extractions may also be done to allow for some spontaneous correction of malocclusions.³ When correcting canine and lateral incisor transpositions, care needs to be taken to avoid loss of buccal attachment of the canine, which may lead to an excessively long clinical crown.⁴

The best aesthetic and functional result is usually achieved when a tooth is in its correct position. This is not always easy to achieve. We would like to demonstrate how we achieved correction of a few complicated transpositions involving impacted canines, in three girls at the same year in school, with the use of certain modified jigs and palatal arches, to help give a very acceptable result.

Case 1

The first case presented at age 11 years, with a Class III incisor relationship on a mild Class III skeletal base, average vertical proportions and incompetent lips. She presented in the late mixed dentition with retained deciduous canines and unerupted upper canines. The lower labial segment was well-aligned with retroclined lower incisors. The upper labial segment was crowded with incisors of an average inclination whilst the buccal segments were well-aligned.

The overjet was -2 mm and the overbite was 80% with Class I molars bilaterally. The centrelines were co-incident (Figure 1 a-c).

Radiographs showed that the permanent canines were transposed with the lateral incisors and there was some pre-existing root resorption of the upper central incisors and the upper right lateral incisor (Figure 2).

Treatment plan

The proposed treatment plan was as follows:

- Upper removable appliance to procline the upper central incisors. The patient was cautioned about risks to the incisor roots and unpredictable mandibular growth.
- Extraction of the upper deciduous canines, exposure and bonding of the unerupted upper permanent canines. This was to be a 2-stage procedure to move the canines horizontally and then vertically with the help of jigs. Brackets on the lateral incisors were

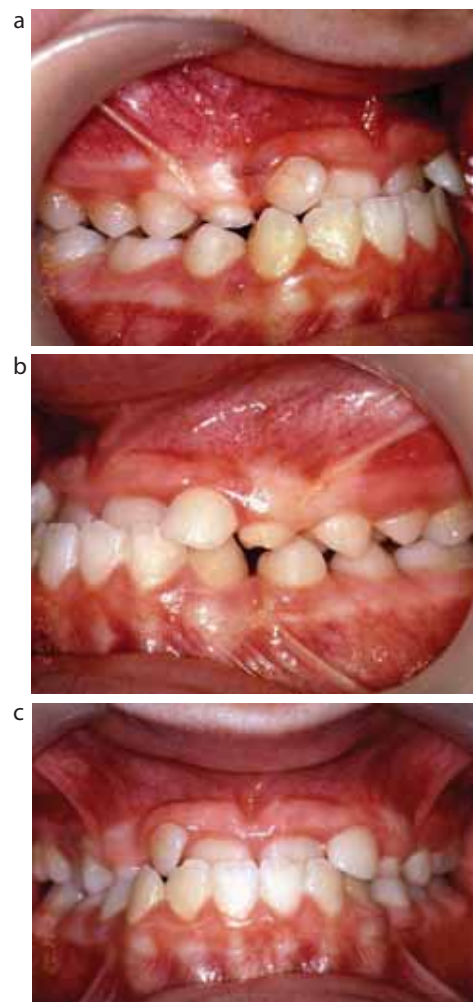


Figure 1. (a, b, c) Pre-treatment photographs, showing location of canines.



Figure 2. Pre-treatment OPT.

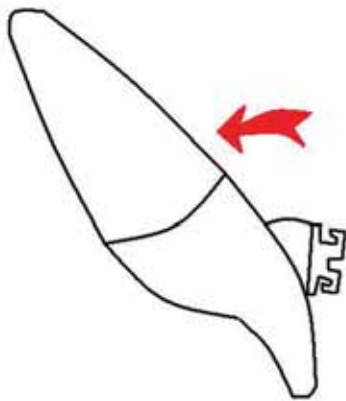


Figure 3. Diagrammatic representation of the lateral incisor bracket with extra adhesive to torque the incisor roots.

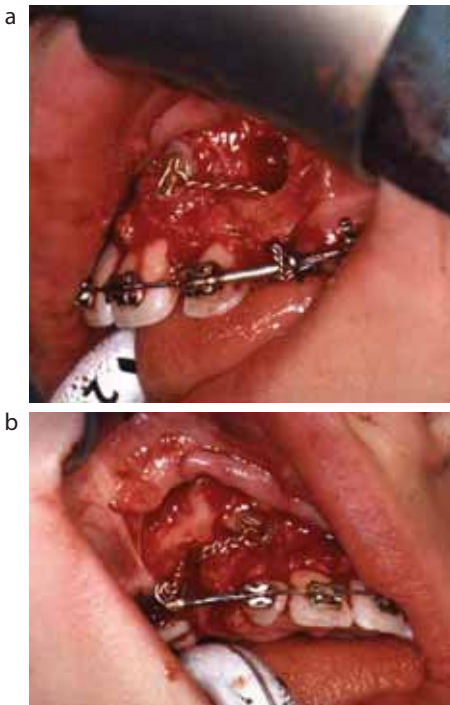


Figure 5. (a, b) The surgery to expose the canines and insert the jigs.

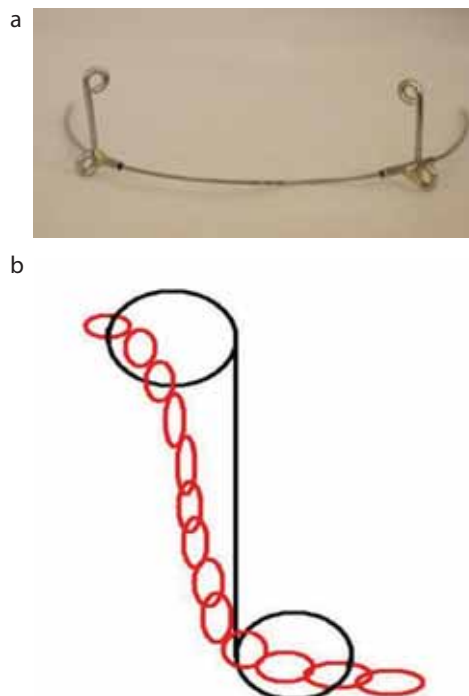


Figure 4. (a, b). Diagrammatic representation of the jig.

bonded so as to be able to move the roots palatally and out of the way of the canines.

- Upper and lower fixed appliances to attempt alignment of the canines using traction.

The patient had been forewarned about the risk of root resorption of the lateral incisor (UR2) and also the possible need to extract the canines if the risks of alignment were too great.

- Retention.

Sequence of events

In December 2002, the upper removable appliance was fitted, which proclined the upper incisors giving a positive overjet in 2 months.

In March 2003, fixed appliances were placed in the upper arch. Care was taken to position the lateral incisor brackets in such a way as to encourage the roots to move palatally and out of the way of the canines (Figure 3). This was achieved by placing a greater quantity of composite resin on the gingival half of the lateral incisor brackets. A 0.017" x 0.025" thermal archwire was used.

In May 2003, a 0.021" x 0.025" thermal archwire was used to torque the upper incisors. Additional palatal root torque was gradually applied to the lateral incisors over the next few months. This helped to move the roots palatally and provide clearance to move the canines across.

In September 2003, the patient underwent an operation under general anaesthesia to remove the deciduous canines, expose the permanent canines and bond a gold chain to them. A jig, with two loops, was constructed in the laboratory and one end of it was inserted into the extraction site. The other end of the jig was attached to the archwire. The purpose of the jig was to move the canine crowns horizontally over the palatally displaced roots of the lateral incisors. The tubing used to make the jig was of the exact dimensions of the space required for the canine, so as to maintain that space till the canine was aligned properly. The gold chains were threaded through both loops of the jig (Figures 4a, b and 5a, b).

In October 2003, elastic separators were used to apply traction to the unerupted canines with the aid of the jigs. This was reactivated over the next few months. Movement of the canines was assessed by the number of links of gold chain seen at each visit. Traction was continued until the canines had moved horizontally over the lateral incisor roots and were in contact with the jigs, at which point the sub-gingival portions of the jigs were removed at the chairside. The archwire component and loop were retained in order to maintain the mesio-distal space of the canine and provide a means of continuous vertical traction using horizontal forces (Figure 6). An OPT was taken to assess root quality and position. This took nine months to achieve (Figure 7 a, b).

Traction to the canines was continued in a vertical direction until the canines were clinically visible. The upper left canine (UL3) was visible clinically in June 2005, whilst the upper right canine (UR3) was seen 5 months later. A 0.017" x 0.025" thermal archwire was used to align the upper arch. A 0.021" x 0.025" archwire was used to express the torque in December

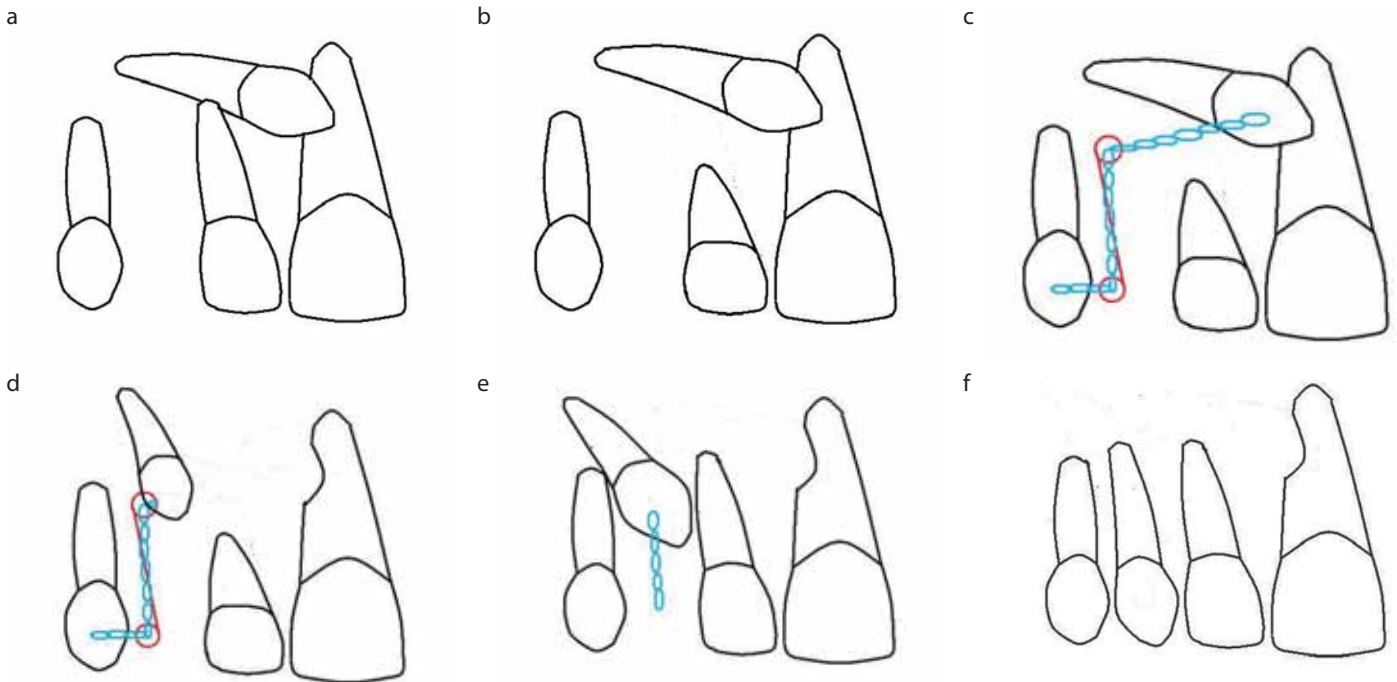


Figure 6. Diagrammatic representation of correction of the canine position. (a) The position of the anterior teeth at the start. (b) Application of torque to the roots of the lateral incisor to move it palatally. (c) Attachment of the jig at surgery. (d) Moving the canine horizontally over the lateral incisor roots. (e) Uprighting of the lateral incisor and moving the canine vertically. (f) The aligned canine.

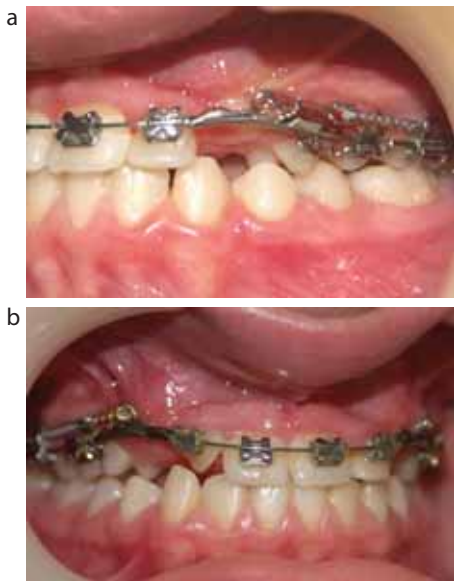


Figure 7. (a, b) Application of traction using the jigs.

2005 (Figure 8).

The lower arch was bonded up in February 2006. Lower incisor stripping was done to overcome the effects of the Class III skeletal base, and a powerchain was used to consolidate the lower arch spaces. The working archwire was a 0.017" x 0.025" thermal archwire.

Over the next six months, individual tooth positioning was carried out by repositioning brackets to get better



Figure 8. The erupting canine.



Figure 9. The aligned canine.

finishing. The lower second molars were also picked up. A powerchain was used to close up any remaining spaces in both arches (Figure 9).

A 0.021" x 0.025" thermal archwire was used to obtain torque expression in both arches over the last 4 months of treatment.

The patient was debonded in February 2007, after 4 years and 3 months of active treatment. Bonded retainers were fitted in both arches (Figure 10a, b).

An OPT and upper standard occlusal radiographs were taken at various stages of treatment in order to monitor the root status of the upper incisors closely (Figures 11a, b and 12).

Case 2

This case presented at age 12 years, with a Class I incisor relationship on a Class I skeletal base and reduced vertical proportions.



Figure 10 (a, b) Right buccal and left buccal views of the final result.

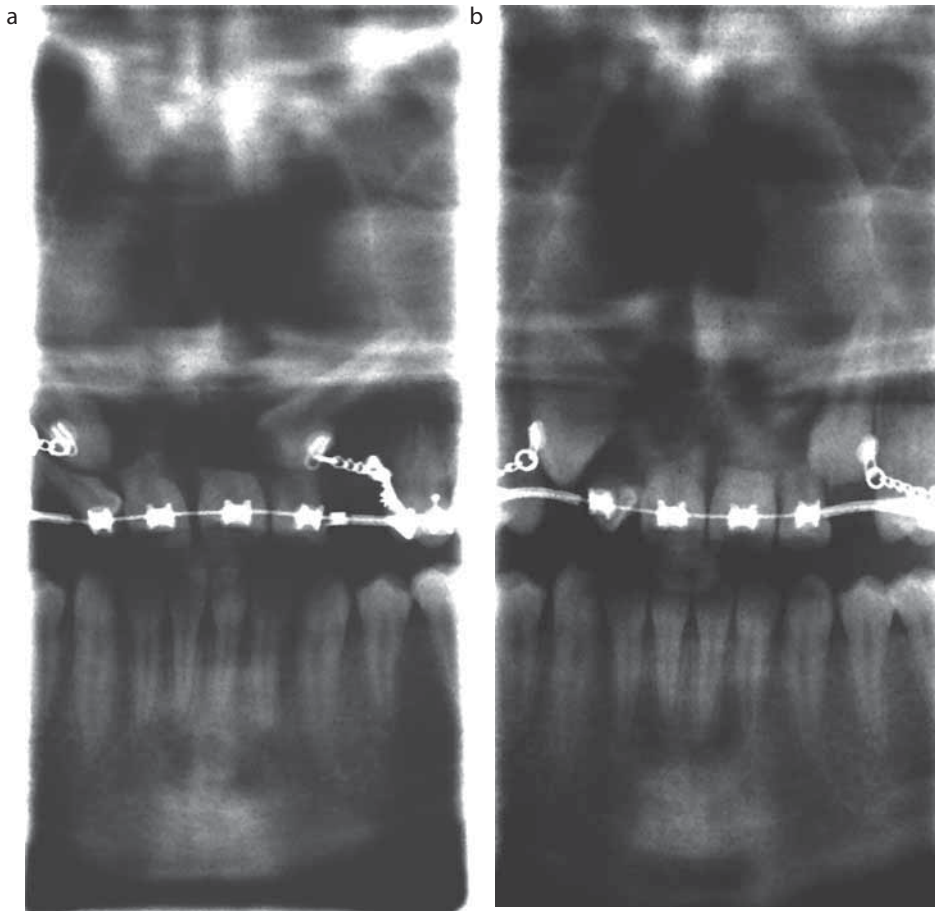


Figure 11. (a, b) Attenuated OPT pictures showing the movement of the impacted canines subgingivally.

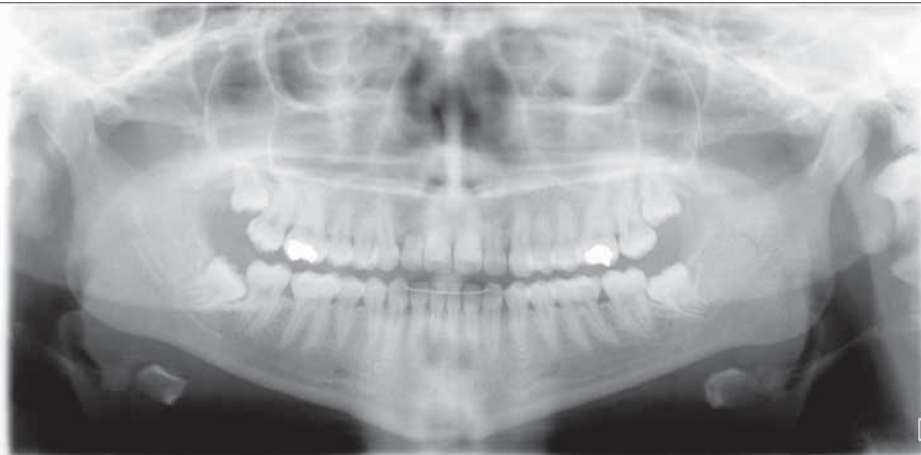


Figure 12. End of treatment OPT.



Figure 13. Start of treatment.



Figure 14. Patient with modified palatal arch in place.



Figure 15. Transposing the canine and lateral incisor.

The patient presented in the permanent dentition with a well-aligned lower labial segment and retroclined lower incisors. The upper labial segment was well-aligned with incisors of an average inclination and transposed upper right lateral incisor (UR2) and canine (UR3), where the canine was positioned mesial to the lateral incisor. Buccal segments were well-aligned.

The overjet was 2 mm and the overbite was 75% with Class I molars bilaterally. The centrelines were coincident (Figure 13).

Treatment plan

The proposed treatment plan was as follows:

- Upper and lower fixed appliances to align all the teeth and correct the canine transposition.
- Retention.

Sequence of events

An upper palatal arch was constructed to provide a palatally directed force in order to reposition the canine, so that the lateral incisor could be moved mesially into its correct position.

In May 2004, the palatal arch was fitted and the upper arch was bonded up. A 0.017" x 0.025" thermal archwire was used in the upper arch. A palatal button was placed on the upper right canine on to which traction was applied from the palatal arch with a powerchain. The canine was then moved palatally over the next few visits (Figure 14).

In November 2004, the palatal arch was removed and traction applied to the canine from the upper right first premolar to move it distobuccally, whilst clearing the root of the lateral incisor. Simultaneously, traction was applied to the lateral incisor to move it mesially (Figure 15).

In March 2005, the canine was

bonded in a reasonable position and engaged on to the working archwire (Figure 16).

In September 2005, the lower arch was bonded up; 0.017" x .025" thermal archwire was used in the lower arch.

In January 2006, a powerchain was used to consolidate spaces in the lower arches and traction was applied from the upper right lateral incisor to the upper left molars to pull the lateral incisor mesially. This was continued till the lateral incisor was in its correct position.

In June 2006, all residual spaces were closed using a powerchain in both arches. Some Class II traction was used to maintain buccal segment relationships.

From September 2006 to January 2007, final detailing was done and second molars were aligned.

In February 2007, the patient was debonded and upper and lower essix retainers were fitted (Figure 17).

The total treatment time was 2 years, 9 months with 21 visits.

An OPT taken close to the end of treatment shows good root positioning overall and especially of the upper right lateral incisor, which was of some concern at the start of treatment (Figures 18, 19).

Case 3

This case presented at age 14 years, with a Class II division 1 incisor relationship on a moderate Class II skeletal base and reduced vertical proportions.

The lower labial segment was mildly crowded with an average inclination of the incisors. The upper labial segment was spaced with proclined incisors. The buccal segments were well aligned with the upper left first premolar (UL4) mesial to the upper left canine (UL3).

The overjet was 7 mm and the overbite was 75%, with full unit Class II molars on the left and right sides. The upper and lower first permanent molars had been previously extracted in 2004 owing to extensive caries (Figure 20).

Treatment plan

A two-stage treatment plan was followed:

- Use of a Twin-Block appliance to reduce the overjet and improve the buccal segment relationships.
- Upper and lower fixed appliances to align all the teeth and correct the canine transposition.
- Retention.

Sequence of events

The Twin-block was fitted in



Figure 16. Transposition completed.



Figure 17. End of active treatment.



Figure 18. Pre-treatment OPT.



Figure 19. Near-end of treatment OPT.



Figure 20. Start of treatment.



Figure 21. Occlusal view of alignment.

April 2006. Full-time wear was advocated till September 2006 after which wear was

reduced to nights only. In January 2007, fixed appliances

were fitted. A 0.017" x 0.025" thermal archwire was used in both arches.

In April 2007, a powerchain was used to align the upper incisors and close spaces in the lower arch (Figure 21).

In July 2007, space closure was continued in the lower arch. In the upper arch, traction was applied from the upper right second molar to the upper left canine to move the canine mesially. Traction was also applied to the upper left first premolar from the upper left second molar to distalize the premolar.

In October 2007, the upper left first premolar was aligned and engaged on to the working archwire (Figure 22a).

In November 2007, the archwires were replaced, traction continued to correct the transposition and Class II elastics were commenced to maintain buccal segment relationships (Figure 22b).

In January 2008, the transposition was corrected and space closure was commenced in both arches, which was continued over the next year. Brackets were rebonded for better positioning as and when required. In May 2008, transpalatal elastics were used for a short period of time to help with better positioning of the premolar.

In February 2009, final repositioning of the brackets was done, and a full thickness archwire was used to express torque on the incisors and canines fully.

The patient was debonded in April 2009 and was fitted with a lower lingually bonded retainer and an upper vacuum formed retainer (Figure 23 a-d).

The total treatment time was 3 years from the Twin-block stage till debond.

Discussion

The three cases discussed above illustrate the use of modified treatment mechanics, along with the use of auxiliaries to enhance treatment and aid in the correction of difficult transpositions. In the first case, following the use of an upper removable appliance to correct the anterior crossbite, a jig was used in order to correct the positions of the canines. Modifications in bracket positioning and use of prolonged traction also helped in this case. In case 2, a modified palatal arch was used in order to move the lateral incisor into a better position and aid in overall treatment mechanics. In Case 3, differential force application and traction was used to correct the transposition and improve the overall tooth positions.

The overall treatment times were definitely higher than the average for straightforward orthodontic treatment.

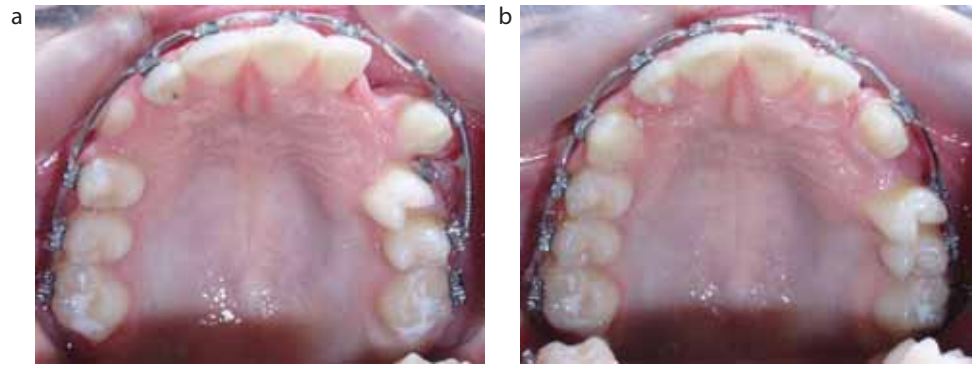


Figure 22. (a, b) Correcting the transposition.



Figure 23. (a-d) End of active treatment.

However, given the complexity of the cases and the end results achieved, the authors feel that the prolonged treatment times were definitely justified.

Complications of these types of treatment are associated with the general risks of prolonged orthodontic treatment like root resorption, decalcification, etc, all of which were explained to the patients. Another possible complication was failure to move the canines, especially in Cases 1 and 2, which was again discussed with the patients.

Conclusion

The illustrated cases go to demonstrate that, although not possible in every single case, the use of auxiliaries and altered treatment mechanics can increase the chances of aligning difficult cases of transposed and impacted canines. As we are aware, the most aesthetic result is usually achieved when the correct teeth are in their rightful position and, as far as possible, it

would be beneficial to attempt to achieve the same.

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