

Case Report

Orthodontic Correction of a Mandibular Lateral Incisor and Canine Incomplete Transposition in the Permanent Dentition

Kadir Beycan, DDS^{1,*} and Nejat Erverdi, DDS, PhD²

ABSTRACT

Transposition of teeth is a rare type of ectopic eruption and in incomplete transposition the crowns might be transposed, but the root apices still remain in their relatively normal positions. In this report, we describe the orthodontic treatment of a 17-year-old girl with mandibular left lateral incisor and canine incomplete transposition in which the involved teeth were repositioned to their normal anatomic position within the dental arch in an acceptable treatment time period. Treatment procedure, mechanics, and sequencing used and final results are described. The final outcome was stable after 18 months of retention. (*Turkish J. Orthod.* 2015;28:55–63)

KEY WORDS: Incomplete transposition, Lower lateral incisor, Nonextraction

INTRODUCTION

Transposition of teeth is a rare type of ectopic eruption, which can be defined as an interchange of position of 2 adjacent permanent teeth in the dental arch or 1 tooth develops or erupts in a position occupied by a nonneighboring tooth.^{1–3} Transpositions are described as incomplete or complete.^{2,4} In a complete transposition, both the crowns and the entire root structures of the related teeth switch places in the dental arch and are fully parallel. In an incomplete transposition (also called “pseudo” or “partial”), the crowns might be transposed, but the root apices still remain in their relatively normal positions; additionally, the crowns and roots of the 2 involved teeth might totally superimpose each other on normally projected radiographs.⁴

Transpositions are most frequently seen in the maxilla, but they are rarely seen in the mandible.^{5–9} Five variations of transpositions have been defined in the maxilla,⁸ and 2 typical variations of mandibular tooth transposition have been described in the mandible.⁵ These include mandibular lateral incisor-canine and mandibular canine transmigrated/erupted. Transposition in the maxilla is almost always a result of displacement and ectopic eruption

of the maxillary canine, transposition in the mandible is typically a result of distal migration of the mandibular lateral incisor, and the mandibular canine develops and erupts in its relatively normal anatomic position.¹⁰ The mandibular lateral incisor and the canine tooth transposition is rare.¹¹ The prevalence rate of mandibular transposition has been reported as 0.03%.⁶

Various theories have been proposed to account for the etiology of transposition. These include the presence of retained primary teeth,¹² altered eruption paths,¹³ trauma,¹⁴ and genetic interchange of developing tooth buds^{1,5}; however, the etiology of transposition is still unclear. Genetics has been suggested to be the fundamental etiology for dental transpositions.^{1,5,8,11,15}

***Corresponding author:** Kadir Beycan, Marmara Üniversitesi, Diş Hekimliği Fakültesi, Ortodonti AD, Teşvikiye mah. Büyükçiftlik sok. No:6 K.3, 34365, Nişantaşı, Şişli, İstanbul, Türkiye. Tel: 0 212 231 91 20-418 E-mail: orthodonty@hotmail.com

To cite this article: Beycan K, Erverdi N. Orthodontic correction of a mandibular lateral incisor and canine incomplete transposition in the permanent dentition. *Turkish J Orthod.* 2015;28:55–63 (DOI: <http://dx.doi.org/10.13076/TJO-D-14-00028>)

Date Submitted: September 2014. Date Accepted: November 2014.

Copyright 2015 by Turkish Orthodontic Society

¹PhD student, University of Marmara, School of Dentistry, Department of Orthodontics, Istanbul, Turkey

²Professor, University of Marmara, School of Dentistry, Department of Orthodontics, Istanbul, Turkey



Figure 1. Pretreatment facial and intraoral photographs.

There are many published case reports that have described correction of transposed teeth in the maxilla²; however, there are few and rare reports describing the correction of mandibular lateral and canine transposition due to low prevalence, and the patients in these reports had been diagnosed before the eruption of the permanent canine.¹⁶

This case report presents the successful orthodontic treatment of a female patient in permanent dentition who showed an incomplete mandibular lateral incisor and canine transposition in which the related teeth were repositioned to their normal positions without any dental extraction in an acceptable treatment time period (28 months). The mechanics used and the final results are presented.

DIAGNOSIS

A 17-year-old girl's chief complaint was lingually positioned lower incisor. Her medical history revealed no contraindication to the orthodontic treatment and there were no signs of temporomandibular joint symptoms. She had a symmetric face with competent lips, average smile line with consonant smile arch, and orthognathic profile. The intraoral examination showed that the patient had good oral hygiene, and the periodontium was healthy. She had Class I molar and canine relationships bilaterally (Fig. 1); mandibular permanent left lateral incisors had erupted between mandibular left canine and premolar, with severe distal tipping, distolingual displacement, and 95° mesiolingual rotation of its crown position, the root apex positioned lingual to



Figure 2. Pretreatment panoramic radiograph.

the permanent canine root. There were small diastemas distal to laterals on the upper arch and distal to canines on the lower arch. The lower dental midline deviated 1.5 mm to the left, and the upper midline was coincident with the facial midline. Arch length discrepancies in the upper and lower arches were 1.5 mm and -1 mm, respectively.

The panoramic radiograph revealed the incomplete type of the transposition of the lower left lateral incisor and canine: the crowns and roots of the 2 involved teeth totally superimposed each other on the radiograph, the lateral incisor had displaced distally superimposing with the canine



Figure 3. Periapical radiograph shows incomplete transposition of left lateral incisor and canine.



Figure 4. Pretreatment lateral cephalometric radiograph.

root (Figs. 2 and 3). Upper and lower third molars were erupting. The initial lateral cephalometric tracing (Fig. 4) showed that the patient had Class I skeletal relationship with low angle vertical pattern (Table 1). The upper and lower incisors were proclined.

TREATMENT OBJECTIVES

The primary treatment objectives for this patient were to correct incomplete transposition and establish natural tooth order, maintain Class I canine/molar relationship bilaterally, coordinate dental midlines, and obtain normal overjet and overbite.

TREATMENT ALTERNATIVES

Since there was sufficient space for the accommodation of the lateral incisor, any tooth extraction was not indicated. Therefore, 2 treatment options were proposed to the patient and her parents: alignment of the teeth in transposed position and orthodontic movement of the lateral incisor to its correct position in the arch. Alignment of the teeth in transposed positions would necessitate cosmetic reshaping of the lateral incisor and canine at the end of the treatment, and moving the teeth into their normal positions could create risk of damaging the teeth or supporting structures. The patient and the family were informed about 2 possible options and their consequences and they desired alignment of the tooth in its correct position.

Table 1. Summary of the cephalometric analysis

Skeletal Evaluation	Standard	Pretreatment	Posttreatment
Vertical			
\sum	396 \pm 3	378	380.8
GoMe-SN, degrees	32 \pm 7	25	24
Maxillary height, degrees	60	56	59
FMA, degrees	25	17	17
Sagittal			
SNA, degrees	82 \pm 2	82	81
SNB, degrees	80 \pm 2	80	80
ANB, degrees	2	2	1
NperA, mm	-1	-0.8	-1.5
Maxillary depth, degrees	90	89	88
ACB/corpus	X/X+7	71.8/72.8	72/73
Dental evaluation			
I-SN, degrees	103	113	112
IMPA, degrees	90	95	97
Holdaway	1/1	1.3/3.2	1.8/3.4
Soft tissue profile			
Nasolabial angle, degrees	90-110	119	118
Upper lip-E line, mm	-4	-6.4	-7.3
Lower lip-E line, mm	-2	-4.1	-4.6

TREATMENT PROGRESS

Orthodontic brackets (0.018-inch slot, preadjusted Roth edgewise appliances) were placed on the maxillary and mandibular teeth except the lower left lateral incisor, and the initial alignment started with 0.014-inch nickel-titanium (Ni-Ti) archwires. After initial alignment, 0.016 \times 0.016-inch Ni-Ti wire was placed in the upper arch and 0.016-inch stainless steel wire was placed in the lower arch with a compressed coil spring extending between the lower left canine and the central incisor brackets. A coil spring was used to distalize the lower left canine, correct lower midline discrepancy, and open up space for the lingually positioned lower lateral incisor. Then, a bracket was bonded to the lateral incisor tooth and an elastomeric chain extending between the mesial wing of the lateral incisor brace and the lower central incisor brace was placed (Fig. 5A,B). The elastomeric chain was changed every 3 weeks to maintain the activation. Four months after the initial elastomeric chain placement, 2 bonded buttons were placed on the lingual surfaces of the lower left first premolar and the lower left lateral incisor. Then, 2 elastomeric chains were used to derotate the lateral incisor. The first elastomeric chain was extended between the mesial wing of the lower lateral incisor bracket and the lingual button on the lower left first

premolar. The second elastomeric chain was extended between the lingual button on the lateral incisor and the lower incisor braces (Fig. 5C,D). The elastomeric chains were renewed every 3 weeks. After 3 months, rotation was corrected and the lateral incisor tooth was aligned using the lingual button and again with an elastomeric chain (Fig. 5E,F). After levelling and alignment of the incisor, ideal torque was attained using 0.016 \times 0.022-inch beta-titanium alloy archwire with accentuated buccal root torque applied on the lower left lateral incisor. Upper diastemas distal to laterals were closed using a 0.016 \times 0.022-inch beta-titanium alloy archwire with T loops (Fig. 6). Class I molar and canine relationships were maintained, and the treatment was finished with 0.016 \times 0.022-inch stainless steel archwires with ideal torque and shape.

When the braces were debonded, upper and lower canine-to-canine fixed lingual retainers were placed for retention.

TREATMENT RESULTS

The active treatment time was 28 months. The facial pattern was maintained (Fig. 7), and treatment objectives were achieved. Class I canine and molar relationships were preserved, and normal tooth alignment with a better midline coincidence and normal overjet and overbite were achieved.

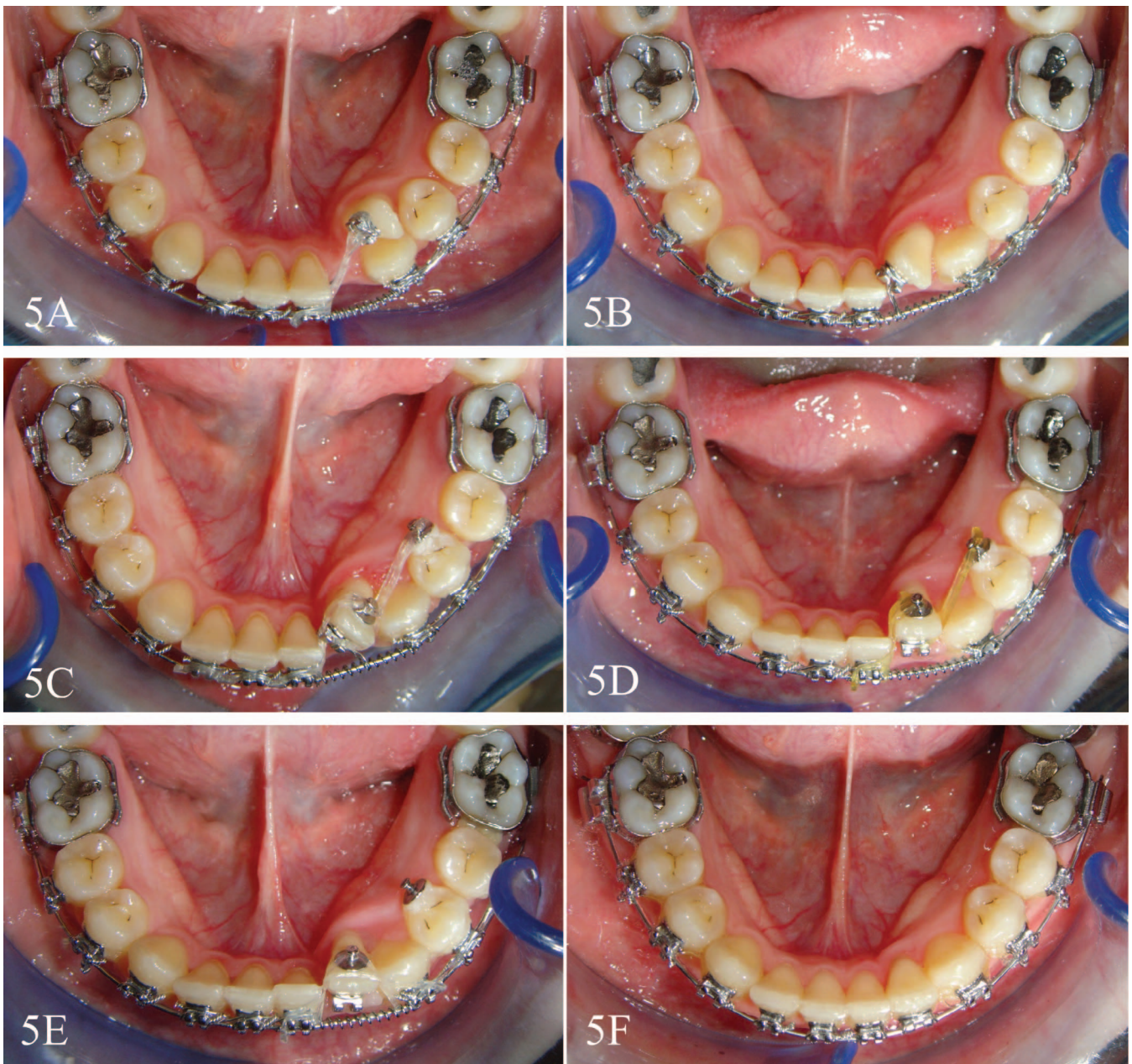


Figure 5. (A, B) Initial elastomeric chain application. (C, D) Derotation of lateral incisor. (E, F) Final alignment of lateral incisor.



Figure 6. Closing of upper diastemas.



Figure 7. Posttreatment facial and intraoral photographs.

The incomplete transposition was corrected, and proper alignment and original tooth order were attained. The posttreatment extraoral photographs showed a pleasing smile with a favorable smile arc. The patient was pleased with her teeth. In the panoramic radiograph, root parallelism was good, and no sign of apical resorption or damage to the canine or lateral incisor was seen (Figs. 8 and 9).



Figure 8. Posttreatment panoramic radiograph.

Cephalometrically, the patient had a similar dental pattern as in the beginning of the treatment as seen in the final cephalogram and the superimposition (Table 1; Figs. 10 and 11). At the 18-month follow-up, the patient had a stable occlusion, with the results of the orthodontic treatment maintained (Fig. 12).

DISCUSSION

Before deciding the appropriate treatment plan for the transposed teeth, several factors including patient's age, occlusion, esthetics, patient cooperation, periodontal support, and treatment length should be taken into consideration to prevent any damage to the teeth and the supporting structures.¹⁷ The initial root positions and inclinations of the involved teeth and the adequacy of bone in which to move the transposed teeth must be carefully evaluated.¹⁸



Figure 9. Posttreatment periapical radiograph.

The position of impacted and transposed teeth can be examined thoroughly with a dental computed tomography scan, which has a radiation dose lower than the medical computed tomography scans and allows the dentists to obtain 3-dimensional information.^{19,20} For our patient, initial panoramic and periapical radiographs and intraoral



Figure 10. Posttreatment cephalometric radiograph.

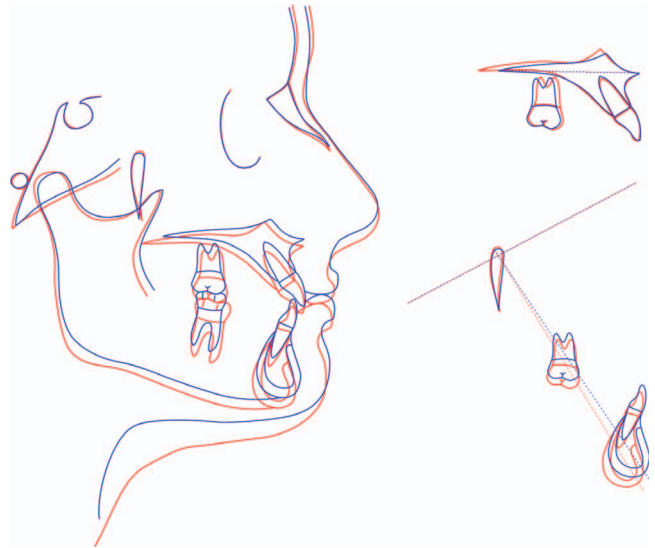


Figure 11. Cephalometric superimposition. Blue, pretreatment; red, posttreatment.

pictures confirmed the initial root positions, and we did not want to expose the patient to extra radiation.

Orthodontic management of transposed teeth can be achieved in different ways,²¹ and 3 different treatment approaches were reported for the treatment of mandibular incisor canine transposition.^{2,9,12,22,23} When transposition is detected early enough (i.e., between 6 and 8 years of age), it can be corrected without extraction by using fixed orthodontic appliances. This approach includes extracting deciduous teeth and guiding the eruption of the transposed tooth into the normal position, while the space is maintained by a lingual arch or a palatal bar. Usually, this approach is possible only if the teeth are tilted so that the roots are near the desired position. If the transposition is noticed after the transposed teeth have erupted in their transposed position or where the roots of the involved teeth are parallel, moving the affected tooth into its normal position in the mandible is not recommended because of the potential for damage to the teeth and supporting structures where dense compact bone occupies its buccolingual thickness. At this stage, the treatment alternatives are permanent-tooth extractions and maintaining the transposition.

For incomplete transpositions where the crowns are transposed but the root apices are in their relatively normal positions, uprighting and rotating the involved teeth is the procedure most often required to place them in their normal alignment, provided enough space is available in the arch.²



Figure 12. Retention facial and intraoral photographs at 18 months.

Peck and Peck⁸ suggested correcting only incomplete transpositions and maintaining the transposed tooth order in all types of complete transpositions.

For this patient, sufficient space for the accommodation of the lateral incisor, relatively normal positioned root apices of the related teeth, adequate bone in which to move the transposed lateral incisor, and the patient's willingness for treatment combined to create a path for correcting the incomplete transposition.

The treatment results were stable after 18 months of retention (Fig. 12).

CONCLUSIONS

Incomplete transpositions can be corrected orthodontically. This case report showed the successful orthodontic treatment of incomplete transposition without any dental extraction, damage to the teeth

and supporting structures in an acceptable treatment time.

REFERENCES

1. Peck L, Peck S, Attia Y. Maxillary canine-first premolar transposition, associated dental anomalies and genetic basis. *Angle Orthod.* 1993;63:99–109.
2. Shapira Y, Kuflinec MM. Tooth transpositions: a review of the literature and treatment considerations. *Angle Orthod.* 1989;59:271–276.
3. Peck S, Peck L, Hirsh G. Mandibular lateral incisor-canine transposition in monozygotic twins. *ASDC J Dent Child.* 1997;64:409–413.
4. Shapira Y, Kuflinec MM. Maxillary tooth transpositions: characteristic features and accompanying dental anomalies. *Am J Orthod Dentofacial Orthop.* 2001;119:127–134.
5. Peck S, Peck L, Kataja M. Mandibular lateral incisor-canine transposition, concomitant dental anomalies, and genetic control. *Angle Orthod.* 1998;68:455–466.
6. Järvinen S. Mandibular incisor-cuspid transposition: a survey. *J Pedod.* 1982;6:159–163.

7. Peck S. On phenomenon of intraosseous migration of nonerupting teeth. *Am J Orthod Dentofacial Orthop.* 1998; 113:515–517.
8. Peck S, Peck L. Classification of maxillary tooth transpositions. *Am J Orthod Dentofacial Orthop.* 1995;107:505–517.
9. Taner T, Uzamiş M. Orthodontic management of mandibular lateral incisor-canine transpositions: reports of cases. *ASDC J Dent Child.* 1999;66:110–115, (85).
10. Shapira Y, Kufninec MM. A unique treatment approach for maxillary canine-lateral incisor transposition. *Am J Orthod Dentofacial Orthop.* 2001;119:540–545.
11. Chattopadhyay A, Srinivas K. Transposition of teeth and genetic etiology. *Angle Orthod.* 1996;66:147–152.
12. Laptook T, Silling G. Canine transposition: approaches to treatment. *J Am Dent Assoc.* 1983;107:746–748.
13. Gholston LR, Williams PR. Bilateral transposition of maxillary canines and lateral incisors: a rare condition. *J Dent Child.* 1984;51:58–63.
14. Dayal PK, Shodhan KH, Dave CJ. Transposition of canine with traumatic etiology. *J Indian Dent Assoc.* 1983;55:283–285.
15. Shapira Y, Kufninec MM. Early detection and prevention of mandibular tooth transposition. *J Dent Child (Chic).* 2003; 70:204–207.
16. Doruk C, Babacan H, Bıçakçı A. Correction of a mandibular lateral incisor-canine transposition. *Am J Orthod Dentofacial Orthop.* 2006;129:65–72.
17. Maia FA. Orthodontic correction of a transposed maxillary canine and lateral incisor. *Angle Orthod.* 2000;70:339–348.
18. Parker WS. Transposed premolars, canines, and lateral incisors. *Am J Orthod Dentofacial Orthop.* 1990;97:431–448.
19. Ludlow JB, Ivanovic M. Comparative dosimetry of dental CBCT devices and 64-slice CT for oral and maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2008;106:106–114.
20. Naitoh M, Hiraiwa Y, Aimiya H, Gotoh K, Arijji E. Accessory mental foramen assessment using cone-beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009;107: 289–294.
21. Weeks EC, Power SM. The presentations and management of transposed teeth. *Br Dent J.* 1996;181:421–424.
22. Shapira Y, Kufninec MM, Stom D. The ectopically erupted mandibular lateral incisor. *Am J Orthod.* 1982;82:426–429.
23. Shapira Y, Kufninec MM. Orthodontic management of mandibular canine-incisor transposition. *Am J Orthod.* 1983;83:271–276.