

Management of incomplete transposition of mandibular lateral incisor using removable appliances: Two case reports

Selcuk Savas^{1*}, Nazli Candabakoglu², Ebru Kucukyilmaz¹, Ilknur Veli²

¹Departments of Pediatric Dentistry and ²Orthodontics, Izmir Katip Celebi University, Cigli, Izmir, Turkey

ABSTRACT

The aim of this case report was to present treatment of two cases involving the incomplete transposition of a mandibular lateral incisor to a canine site using two different removable appliances. The two 8-year-old girls were referred to our clinic from a general dentist with a complaint of a malpositioned permanent mandibular lateral incisor. Based on the clinical and radiographic examination, a treatment plan was devised. The plan was to correct the transposition and the axial inclination and rotation of the lateral incisor with a removable appliance as the patient was in the mixed dentition stage. The appliances were constructed with 2 adams clasps and a modified vestibular arch on which a crimpable hook was welded. A button was attached to the lingual surfaces of the lateral incisors, and a 1/8 light elastics was placed between the button and crimpable hook in both two patients. The patients were evaluated every 2 weeks with an appointment. At the end of the treatment, the ectopically erupted lateral incisors were uprighted and aligned in their normal positions in the dental arch. In early mixed dentition period, if transposition is suspected, with early and correct diagnosis and with sufficient forethought a pediatric dentist may avoid the need for fixed orthodontic treatment.

Key words: Dental anomaly, Early orthodontic treatment, Incomplete dental transposition, Removable orthodontic appliances, Transposed mandibular lateral incisor

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INTRODUCTION

Transposition is a relatively rare dental anomaly that can be identified as the ectopic eruption of a tooth in the place of a nonadjacent one or displacement of two adjacent teeth from each other.^[1] The prevalence of transposition remains under 1% in most series and varies according to the race and region studied (e.g., 0.38% in Turkey, 0.40% in India, 1.4% in Nigeria, 0.09% in Greece).^[1-5] Although transpositions affect both sexes, it appears that more female patients develop this anomaly than their male counterparts.^[6,7]

The etiology of transposition is still unclear. Migration of a tooth during eruption, transposition of the tooth germ during odontogenesis, early loss of primary teeth, presence

of cysts, heredity, and trauma have been identified as potential etiological factors.^[2,8,9]

Although dental transposition can affect both the maxillary and mandibular arch, it generally occurs in the maxilla.^[3,10] Transposition in the maxilla is generally a result of ectopic eruption and displacement of the maxillary permanent canine, whereas transposition in the mandible is typically the result of distal migration of the mandibular permanent lateral incisor.^[8] The majority of cases involve the canine/first premolar in the maxilla and the canine/lateral incisor in the mandible.^[1,6]

Transposition cases are generally classified according to the included teeth and jaw. In addition, dental transposition can also be classified as incomplete or

*Address for correspondence

Res. Assist. Selcuk Savas, Department of Pediatric Dentistry, Faculty of Dentistry, Izmir Katip Celebi University, Cigli, Izmir, Turkey.
E-mail: selcuksavas1983@hotmail.com

complete transposition. When the crowns are transposed but the root apices remain in their natural positions, it is defined as incomplete transposition and when the crowns and the roots of the involved teeth exchange places in the dental arch it is described as complete transposition.^[10,11] The prevalence ratio of complete/incomplete transposition was reported 15/7.^[5]

The treatment of the transposed teeth depends on the eruption stage and the type of the involved teeth. In the mixed dentition, if the transposition is in an early stage (the transposed teeth have not yet erupted in their transposed position), the position of the teeth can be corrected by the aid of removable appliances or fixed orthodontic treatment after extraction of the adjacent primary tooth. If the transposed teeth have erupted in their transposed position, it is not preferred to correct the position of the involved teeth. In these situations, treatment could be considered according to the arch length as extraction or aligning of the transposed teeth.^[12] Hence, extraction of one or both transposed teeth, arrangement of the teeth in the transposed position, correction of the intra-arch position of the teeth with orthodontic tooth movement and interceptive treatments are considered as treatment modalities.^[12,13] Canoglu *et al.*^[13] presented the management of mandibular permanent lateral incisor and the canine transposition using removable orthodontic appliances. The aim of this case report was to present treatment of two cases involving the incomplete transposition of a mandibular lateral incisor to a canine site.

CASE REPORTS

Case 1

An 8-year-old girl was referred to the Department of Orthodontics from Pediatric Dentistry Clinic from a general dentist with a complaint of a malpositioned permanent mandibular left lateral incisor. Extra-oral examination revealed that she had convex profile. Her upper and lower lips are in the posterior position

according to E-line. The patient was in the transitional dentition stage with a Class I molar relationship, 2 mm of overbite and 2 mm of overjet. The periodontium was healthy and oral hygiene was good. The mandibular dental midline deviated 3 mm to the left compared to maxillary and facial midlines [Figure 1a]. Cephalometrically, a skeletal Class II malocclusion was evident with bialveolar retrusion. Intraoral examination showed that the crown of the permanent lateral incisor was in the place of permanent canine [Figure 1b and c]. The panoramic radiograph indicated that the transposition was incomplete, with the root apices in their normal position [Figure 1d]. The permanent mandibular left canine had not yet erupted. To evaluate the relationship between the transpositioned lateral incisor and permanent canine, cone beam computed tomography (CBCT) (Newtom 5G, QR, Verona, Italy) images were obtained. CBCT results showed that the crown of permanent left mandibular lateral incisor was positioned in a permanent canine place with a 90° mesiolingual rotation. The roots remained in their natural position, and no contact between the permanent canine and lateral incisor roots was observed [Figure 1e]. Based on the clinical and radiographic examination, a treatment plan was devised. The plan was to correct the transposition and the axial inclination and rotation of the lateral incisor with a removable appliance as the patient was in the mixed dentition stage. Treatment was started with the extraction of the retained primary canine, and an alginate impression was taken 1-week after the extraction procedure waiting for healing in order to construct the removable appliance. The appliance was constructed with 2 adams clasps and a modified vestibular arch on which a crimpable hook was welded. A button was attached to the lingual surface of the lateral incisor, and 1/8 inch light elastics was placed between the button and crimpable hook [Figure 2a and b]. The patient was instructed to wear elastics except while eating. The patient was seen in every 2 weeks to check elastic use and the movement of the tooth. Furthermore, oral hygiene motivation was provided. After 4 months, the lateral incisor was uprighted

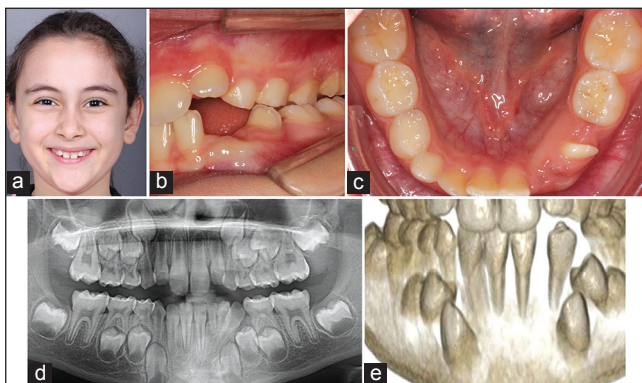


Figure 1: (a-e) Extra-oral/intraoral photographs and radiographs of the patient before orthodontic treatment

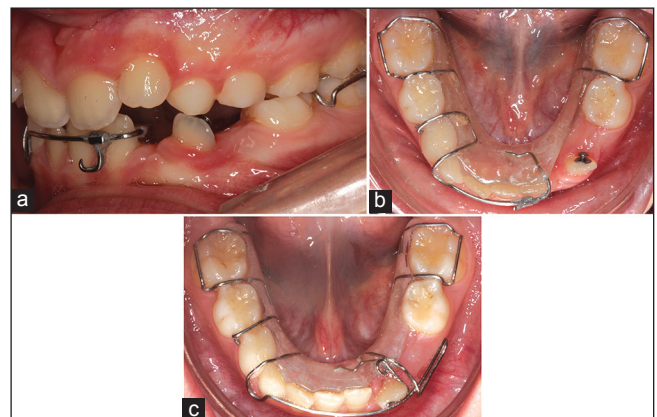


Figure 2: (a-c) Application of the removable appliance

vertically, and it was placed in a normal position in the dental arch with minimal rotation. At this appointment, a new removable appliance including a labio-lingual spring was fabricated to correct the rotation [Figure 2c]. At the end of 9 months of treatment and follow-up, radiographic evaluation showed that the roots of the transposed permanent mandibular lateral incisor were parallel [Figure 3b]. There were no signs of complications associated with the tooth movement. The uprighting and mesial movement of the permanent mandibular lateral incisor allowed the eruption of the permanent canine into the normal location, but because of the lower midline deviation and mild crowding following removable appliances, further orthodontic treatment with fixed appliances was planned [Figure 3a-c].

Case 2

An 8-year-old girl was referred to the Department of Orthodontics from Pediatric Dentistry Clinic from a general dentist with the complaint of a transposed permanent mandibular right lateral incisor. Extra-oral examination revealed that she had a convex profile. She was in the mixed dentition stage and had a Class I dental and Class II skeletal relationship on both sides with 3 mm overjet and 4 mm overbite. The mandibular midline was coincident with the facial midline [Figure 4a]. The intraoral evaluation revealed that the right mandibular lateral incisor had erupted between the primary canine and second molar teeth [Figure 4b and c]. Cephalometric analysis indicated a skeletal Class II malocclusion with bialveolar retrusion. The panoramic radiograph indicated that the transposition was incomplete, with the root apices in their normal position [Figure 4d]. CBCT images were taken to evaluate the relationship between the lateral incisor and permanent canine roots. CBCT evaluation revealed that there was no root contact between the lateral incisor and permanent canine roots [Figure 4e and f]. As the patient was in mixed dentition and the lateral incisor was distally tipped,

removable appliance therapy was initiated. An alginate impression of the mandibular arch was obtained, and the removable appliance was fabricated with 2 Adams clasps and a modified labial bow. A crimpable hook was soldered on a labial bow, and a button was bonded to the lingual surface of the lateral incisor. 1/8 inch light elastics were used between the button and the crimpable hook. The patient was instructed to wear elastics except while eating. The patient was seen in every 2 weeks to check elastic use and the movement of the tooth. Also, oral hygiene motivation was provided. After 4 months, in order to move the tooth without rotation, a button was bonded to the labial surface of the lateral incisor and an attachment was added to the lingual acrylic plate [Figure 5a and b]. The same type of elastics was applied to both lingual and buccal surfaces to move the tooth. At the follow-up visit at 9 months, radiograph evaluation confirmed that the roots were parallel [Figure 6a] and the ectopically erupted lateral incisor were uprighted and aligned in its normal position in the dental arch. The final overbite and overjet are 1 mm and 2 mm, respectively. The final mandibular midline is shifted to right 0.5 mm [Figure 6b and c]. This treatment procedure guided the eruption of the permanent canine into the normal position. Further orthodontic treatment is needed to align teeth and achieve good occlusion.

DISCUSSION

Tooth transposition is a form of ectopia and characterized by the ectopic eruption of a tooth in the place of a nonadjacent tooth or positional interchange of two adjacent teeth.^[1,14] Dental transposition has been widely reported in the literature.^[3-5] Transpositions have been more commonly observed in females and generally occur in the maxilla and unilaterally (left side dominant).^[15,16] In the cases presented here, both patients are female and transpositions were observed unilaterally consistent with the literature. However, in case 1 the transposition occurred in the mandibular left segment, while that in case 2 occurred in the mandibular right segment.

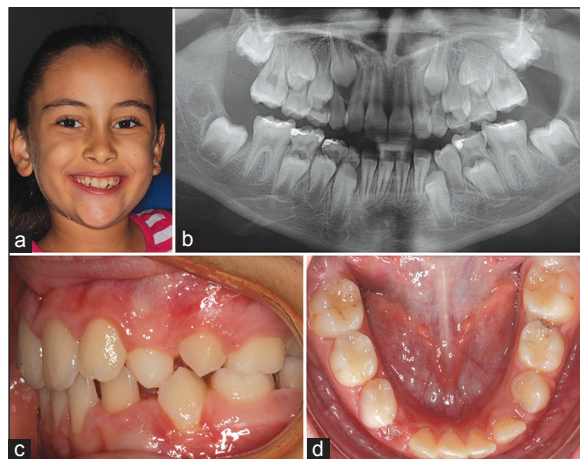


Figure 3: (a-d) Extra-oral/intraoral photographs and radiographs of the patient after orthodontic treatment

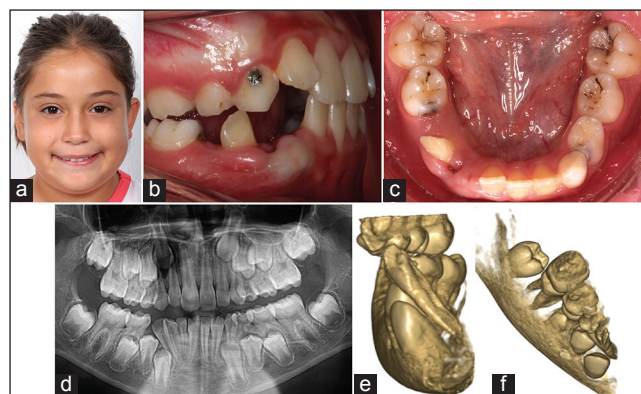


Figure 4: (a-f) Extra-oral/intraoral photographs and radiographs of the patient before orthodontic treatment

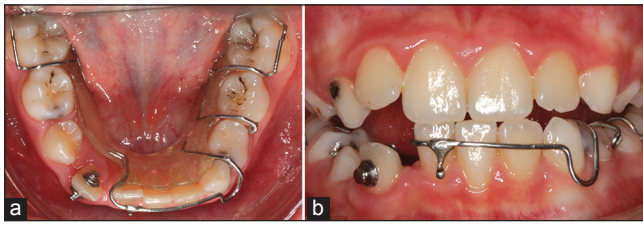


Figure 5: (a and b) Application of the removable appliance

Mandibular tooth transpositions are seen less frequently and with less variety than those in the maxilla.^[2,8] Mandibular tooth transpositions account for approximately 20% of all tooth transpositions.^[17] Based on data from published surveys, transposition in the mandible generally involves lateral incisor and canine teeth, which is caused by distal migration of mandibular lateral incisors.^[13] In the cases presented above, the typical characteristics of mandibular lateral-canine (Mn.I2.C) transposition, described by Peck,^[1] were observed both clinically and radiographically.

Due to the crown-root positions of the transposed teeth, transpositions may be complete or incomplete. In a complete transposition, the teeth interchange their positions as a whole, whereas, in an incomplete transposition, only the crowns or roots of the teeth are transposed.^[11,13] In both cases, the mandibular lateral incisor had migrated distally, but the roots of the teeth had stayed in their normal position. Hence, both were considered incomplete transpositions.

Mandibular lateral-canine transpositions have a strong relationship with other dental anomalies, such as peg-shaped maxillary lateral incisor and tooth agenesis.^[1,2] In the light of this information, it was recently determined that Mn.I2.C transposition results from genetic influences in a multifactorial inheritance model.^[16] The multifactorial etiologies of a transposition abnormality may include prolonged retention of primary teeth, early loss of primary teeth, lack of root resorption of primary canine teeth and genetic interchange in the position of the developing tooth buds.^[9,16,18] In the cases presented here, no history of ectopia, transposition or any other dental anomalies were found in the patient's family. In our opinion, in both cases the transposition of the permanent mandibular lateral incisor occurred as a result of the early loss of the primary mandibular first molar. After early loss of a first primary molar, the permanent mandibular lateral incisor deflects from its normal path of eruption and migrates distally along the lingual side of the primary mandibular lateral incisor and permanent mandibular left canine, to erupt above the developing permanent mandibular first premolar.

The main goal of treatment of all transposition cases is to correct the esthetic and functional abnormalities

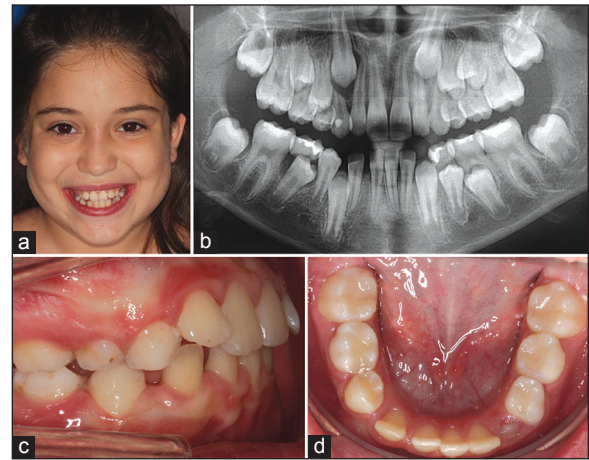


Figure 6: (a-d) Extra-oral/intraoral photographs and radiographs of the patient after orthodontic treatment

of the occlusion. Treatment options for these patients included orthodontic movement of the teeth into their normal anatomic positions in the arch, extraction of I transposed tooth, and alignment of the involved teeth in their transposed positions.^[18-20] Primary treatment should be based on careful consideration of multiple factors, including occlusion, patient cooperation, treatment length, periodontal support, position of the root apices, patient's age and esthetics.^[21] Early diagnosis of a transposition is extremely important and has a great influence on prognosis, especially in the mandible. Correcting the position of the teeth has a high risk of damaging the teeth and supporting structures due to the dense, compact bone of the mandible. The diagnosis of a transposition anomaly may usually be performed by conventional panoramic radiography. When the alteration is detected early (between 6 and 8 years of age), interceptive procedures including extraction of primary teeth and placement of eruption guides for the permanent teeth may be performed to resolve the developing malocclusion.^[13]

In the present cases, the diagnosis of the transposition anomaly was performed before the eruption of the permanent mandibular canine by a conventional radiograph. As a general principle, transposition should be prevented by uprighting and mesially and moving the lateral incisor, when incipient transposition is detected before eruption of the permanent canine tooth.^[13] At this stage, CBCT was performed to evaluate the relationship between the lateral incisor and permanent canine teeth. CBCT results showed that the lateral incisor crown was transposed, but the roots remained in their normal position. No relationship between permanent canine and lateral incisor was observed. Accordingly, the primary mandibular left canine was extracted, and the inclination and rotation of the transposed permanent mandibular lateral incisor were corrected before the eruption of the permanent mandibular canine.

Due to numerous primary teeth, orthodontic treatment was initiated with removable appliances in both cases. Also through the compliance of both patients, no consideration for fixed appliances was planned at the beginning of treatment.

Removable appliances can be taken in and out for cleaning and eating. By this means periodontal health after treatment with these appliances, was achieved. To demonstrate different use of removable appliances, 2 different removable appliance mechanisms were used in the present study. In the first case, the elastics were mainly used to correct rotation. Following the correction of rotation, the tooth was mesialized using C clasp accompanied by elastics. In the second case, only elastics were used to place the tooth in its proper position. In both cases, almost the same results were achieved. Further orthodontic treatment was recommended to provide further adjustments such as midline deviation and space deficiencies.

In order to have stable treatment results; beside the treatment of the malocclusion, functional occlusion, that is, occlusal contacts of the maxillary and mandibular teeth during function, must be established.^[21-23] In the final stage of treatment, parallel roots of the permanent canine and lateral incisor were seen in the final panoramic radiograph. Therefore, in the present cases, functional occlusion was established and stable treatment results, that is, no relapse were achieved beyond the limitations of removable appliance therapy.

It should be noted that the patients are expected to wear removable appliances at all times except eating and tooth-brushing to ensure treatment is successful and is carried out within a reasonable amount of time. Also, the compliance is at utmost level.

CONCLUSION

Treatment of transposition at later ages, that is, after the completion of a permanent dentition, can cause severe results such as development of severe malocclusions, impaction of one of the teeth and aesthetic disorders. Even though the patients would still need further orthodontic treatment afterwards, they patients can be treated effectively without damaging the supporting tissues and the teeth. By this means, the extent of future orthodontic treatment will be lessened. If transposition is suspected, with correct diagnosis and sufficient forethought a pediatric dentist may avoid the need for fixed orthodontic treatment.

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