CASE REPORT

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Mandibular lateral incisor–first premolar transposition in early mixed dentition: a rare case

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Abstract

Dental transposition is an anomaly of eruption which is usually seen in the maxilla and rarely in the mandible. The mandibular lateral incisor's transposition with the permanent canine has a prevalence of less than 0.03%. The following case presents an even rarer situation, of a right lateral mandibular incisor that erupted in the place of the first premolar, in transposition with the temporary canine. In the first phase, a series of extractions have been performed, to ensure the necessary free space for moving the lateral incisor closer to its appropriate place, and after that a fixed orthodontic appliance was used. The biomechanics for intra-arch tooth movement was ingenious enough to ensure a perfect alignment of all permanent teeth and a functional Class I canine and molar final occlusion. Early intervention and successful move of the permanent canine in its correct position ensured the functionality of the mandibular movements and a good long-term prognosis.

Keywords: dental transposition, mandibular transposition, lateral incisor anomaly.

Introduction

The term of 'dental transposition' describes the change in position of a tooth with a neighboring tooth (only the crowns, only the roots or both) or the formation or eruption of a tooth in an ectopic distant position, after intraosseous migration, taking the place of a non-adjacent tooth [1]. Other authors describe it as the change of the dental formula [2]. Transpositions occur more frequently in the maxilla than in the mandible [1, 3–5] and also, they are usually unilateral, not bilateral [5–7]. Transpositions can be complete, when both crowns and roots of the transposed teeth are switched, or incomplete, when the crowns are in transposed position, but the apices are still in their normal position [8, 9], or when the crowns are on their regular position, but the roots are switched [10]. In a study from 2010, the general prevalence of transposition appeared to be 0.33% [3]. For mandibular lateral incisor–canine transposition cases in particular, the prevalence is only 0.03% [1].

For a long period of time, it was thought that this anomaly was present only in the maxilla; only after the year 1907, when Angle presented the treatment of a complex case, involving the change in place of an inferior lateral incisor with an inferior canine, practitioners started to look for this anomaly [11]. Peck & Peck published in 1995 a classification of transpositions in the maxilla and, analyzing 201 cases, they identified five different types: canine–first premolar (143 cases), canine–lateral incisor (40 cases), canine–first molar (eight cases), lateral–central incisors (six cases) and canine–central incisor (four cases) [6]. For the mandible, Peck *et al.* described only two types of transposition: lateral incisor–canine and canine trans-migration [1].

Several theories have been proposed for the etiology of transposition, although the exact cause is still unknown [2, 5]. Many studies found associations between transposition and other dental anomalies, such as anodontia, microdontia or impaction that have a multifactorial inheritance model, so the genetic explanation is the one widely accepted [6, 7, 12]. Other theories, such as congenital deviations during odontogenesis, are mentioned, being explained by the change in position of the dental buds [7, 13]. As secondary causes are mentioned the local ones, that can influence the position of the dental bud or of the evolving tooth, such as trauma, over-retention of temporary teeth, tumors or cysts, lack of space, deviation of the path of eruption, infections [6, 9, 14–16].

The lateral incisor is one of the teeth that recurrently suffer alterations in number or position, since it is the last one to erupt from its group. There are studies that present it as the tooth with the most frequent ectopic eruption [17, 18], or the one that continuously suffers modifications in number, such as anodontia [19] or supernumerary teeth [20]. In the process of eruption, the permanent lateral incisor can, for unknown causes, change its normal eruption path and not follow the resorbing root of the temporary lateral

incisor. In this case, the deciduous tooth remains in the dental arch long after its time of exfoliation and the permanent lateral incisor erupts in a transposition with the permanent canine [21]. If this anomaly is early detected, the incisor is seen in a distal position and the permanent canine just begins its mesial intraosseous movement, so the transposition will be diagnosed only on radiological records [2, 4]; that is the situation of the patient presented in this paper.

Case presentation

The male patient, aged 9, came to our Office for a regular check-up. During the examination, an incorrect dental formula was observed in the lower arch, the right mandibular lateral incisor being erupted in the place of the first premolar, with a mesio-lingual rotation, and the temporary lateral incisor and canine situated mesially to the displaced tooth (Figure 1, A and B). The left side of the arch was harmonious; the occlusal relationship was a bilateral Class II Division 2, a deep bite with the upper central incisors almost fully covering the lower permanent incisors, and the upper lateral incisors buccally displaced and mesio-rotated (Figure 1, C–E).

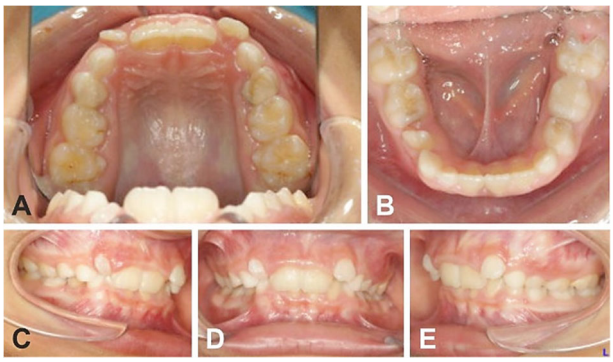

Figure 1 – ***Initial situation of (A) upper arch, (B) lower arch and occlusal relationships from (C) lateral right view, (D) lateral left view, (E) frontal view.***

The radiological examination of a panoramic X-ray and a lateral cephalogram showed the position of the permanent dental buds inside the bone and confirmed the Class II Angle anomaly (Figure 2, A and B). The tooth No. 42 was placed in a distally inclined position, with the crown in an ectopic position, just above the first premolar, having the root almost in its normal place, with only a small distally deviation of the apex compared to its homolog. The temporary teeth, Nos. 82 and 83, had a minimal root resorption, being placed between the right central and lateral incisors. Also, a dentoalveolar disharmony was observed, with both the maxillary and mandibular jaws being insufficiently developed to host all the permanent teeth. The third molars started to develop in all the quadrants. The soft tissue profile was harmonious, but both maxilla and mandible were retruded and the incisors were positioned too straight inside the bone.

The main objectives for this case were to correct the transposition and align the teeth in their natural order, to level and align both dental arches, to achieve stable Class I canine and molar relationships, and to obtain ideal overbite and overjet. The treatment strategy consisted of three stages: during the first one, the temporary teeth needed to be extracted, to allow the uprighting of the right mandibular lateral incisor and to release the pressure on it, from the mesial side. The fact that the apex of the displaced tooth remained in quite a good position was important and minimized the movement of the root. After that, a fixed multi-attached lower appliance was placed to allow a good three-dimensional (3D) control, in Roth prescription, with the brackets on both permanent and temporary teeth for better anchorage. A better position was progressively obtained for the lateral incisor (Figure 3A); during the bonding appointment, it has a less dramatic distalised position and a less important lingual rotation. A lingual button was also added on the displaced tooth, to allow easier rotation mechanics (Figure 3B). After an initial alignment with nickel–titanium (NiTi) wires, an open coil spring could be applied on stiffer wires, allowing the pressure placed distally to the tooth No. 42 to continue its uprighting, and also to increase the space for the still unerupted teeth 43 and 44.

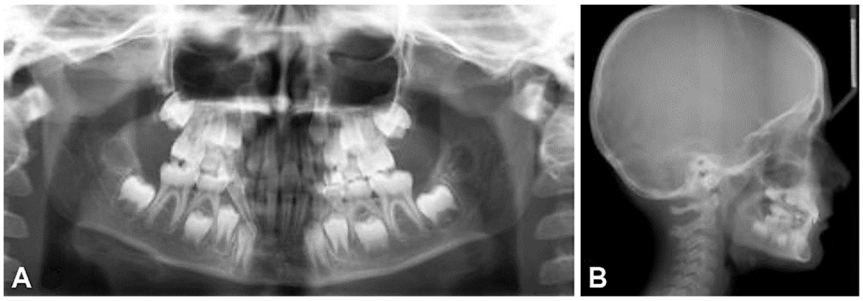

Figure 2 – ***Radiological examination: (A) Panoramic X-ray; (B) Lateral cephalometric X-ray.***

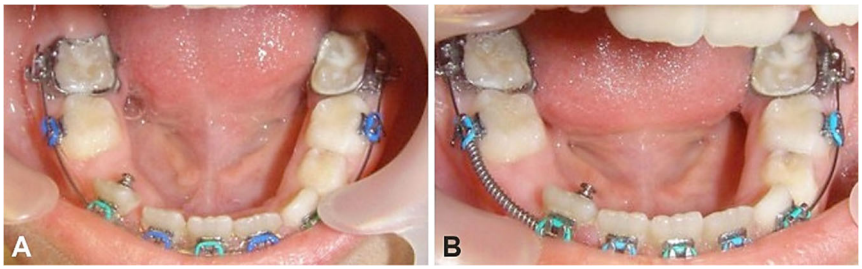

Figure 3 – ***Lateral incisor during treatment stages: (A) Position when bonding the lower fixed appliance; (B) Inclination correction by using open coilspring.***

After a few appointments, even though there was enough space for the canine tooth 43, we observed that it was still not erupting, and also that its volume was situated too mesially on the mandibular jaw, just in front of the lateral incisor. A local radiography was performed that confirmed the fact that the canine was placed too anteriorly (Figure 4), and the decision was made to surgically expose it; during the procedure, the buccally and mesially placed canine and also its rapport to the lateral incisor were observed (Figure 5A) and a button was bonded on it, in order to direct its eruption (Figure 5B). The canine needed urgent distal and vertical tractions to take it away from the lateral incisor's root and to help its eruption. Since the canine was placed very deep inside the bone, the first premolar erupted too mesially (Figure 6), taking a part of its place, so distal tractions had to be placed to regain the canine's space (Figure 7, A and B); the mechanics used to align it were carefully adjusted (Figure 7C). Even though the tooth No. 43 had a very bad position at some time during treatment, we managed to guide it, using clever mechanics, to its ideal place. With light and continuous forces, the right canine erupted in a good position, just like the rest of the lower teeth. Small differences can be seen at the gingival level (the right canine having a slightly lower gingival margin) and also at the root's contour that can be palpated on the right side (due to the original ectopic position of the right canine), but both of them without clinical consequences.

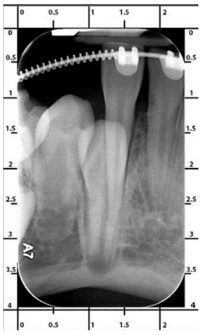

Figure 4 – ***Retroalveolar radiography showing the position of the permanent canine.***

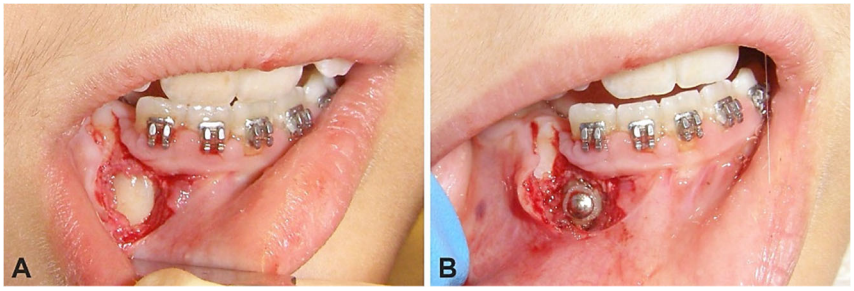

Figure 5 – ***Intraosseous position of the surgically-exposed left canine: (A) Its rapport to the lateral incisor; (B) The button bonded to direct its eruption.***

Figure 6 – ***The left first premolar erupted too mesially.***

Because the upper canines were also very high inside the bone and a lot of deciduous teeth were still present in the maxilla, we have decided to place the upper appliance when the exfoliation process of the lateral teeth began. The buccal inclination of the laterals was little by little corrected when the tips of the upper canines were not pressing on them anymore. One by one, the premolars erupted; the upper canines were the last ones to arrive. Intermaxillary elastics with Class II mechanics were used during the process, guiding the premolars and after that the canine in a Class I position. We have managed to obtain an ideal Class I canine and molar occlusion (Figure 8). The normal positioning of the teeth inside the dental arch contributes to a harmonious functional occlusion and also to good aesthetics, making this case a real success.

The last part of the treatment consisted of maintaining the results, in the contention phase. On the lower arch, a NiTi flexible retainer was bonded from 33 to 43, to make sure both the lateral incisor and the canine, that were really displaced from the ideal position, will keep their place inside the dental arch. The ability to achieve neutral 3D occlusion ensures functionality in the mandibular movements and in every day's processes, giving long-term stability. Also, the continuous arches and the good alignment contribute to the unity of the dentoalveolar complex and to the even distribution of the forces.

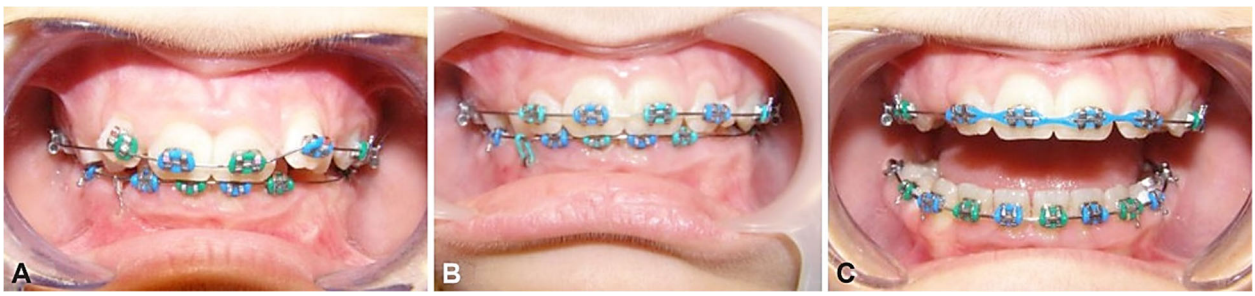

Figure 7 – ***Repositioning of the canine: (A and B) Distal tractions to regain its space; (C) The right canine erupted in a good position.***

Figure 8 – *Final Class I functional and aesthetic occlusion.*

Discussions

A change in place of two adjacent teeth, called transposition, is a dental anomaly that appears in the permanent dentition. So far, no cases of transposition were described in temporary dentition [4]. Our case is a rare one, since only a few cases of mandibular transpositions were presented in the literature [2, 17, 18, 22]. The transposition, as stated by Tanaka *et al*., can be associated with other dental anomalies such as missing, impacted, small or malformed adjacent teeth, rotations and dilacerations [23, 24]. The 9-year-old boy presented here had an incomplete transposition between the right mandibular lateral incisor and canine, the tooth No. 42 being erupted just above the first premolar. The lateral incisor had a severe mesio-lingual rotation of approximately 45°. In the cases of mandibular lateral incisor–canine transposition, from the occlusal view, Peck *et al.* observed that the lateral incisor is often mesio-lingually rotated, even though the neighboring teeth did not exert pressure in this direction [1]. For a proper diagnosis, in cases where a transposition is suspected, Babacan *et al.* suggested to perform a panoramic X-ray or even a local cone beam computed tomography (CBCT), to obtain more information about the position of the transposed tooth and of the adjacent ones, the relation between them, the integrity of the dental structures and the bone, the treatment approach and also the prognosis [25–27].

It is not uncommon for the displaced tooth, for example a distally inclined lateral incisor, to pass after the deciduous lateral incisor and canine and to determine the early exfoliation of the first permanent molar, which was exactly the situation that we discovered during our initial consultation. Negi states that if the ectopic eruption is not discovered during the mixed dentition period, the permanent canine will switch places with the lateral incisor [23].

The lateral incisor–canine transposition is of major importance since they intervene in aesthetics and function. The most frequent transposition encountered in the mandible is the one between the lateral incisor and the canine [1]. It is a difficult situation and a challenge for orthodontic treatment, since cautious movements must be made to correctly position the teeth in the dental arch, taking care to preserve as much as possible the soft tissues and the integrity of the roots. There are several treatment options when this type of anomaly is found. After Loli and other authors, the teeth that are transposed can be aligned in the switched position, one or both of them can be extracted depending on the hard tissues' alterations, or they can be aligned in their normal position [4, 27].

One of the most important aspects is the prevention of anomaly. If a panoramic radiography is made during the mixed dentition, the developing anomaly can be detected early and the interceptive treatment might be successful [15, 24]. The recommended age for clinical and radiological evaluation is between six and eight years [10]. In our case, the parents did not see the lateral incisor that erupted distally, so the treatment began late, after the ectopic eruption of the tooth 42. Luckily, the anomaly was diagnosed before the canine's or first premolar's eruption. Normally, if the temporary teeth are extracted early, the permanent lateral may sometimes regain its natural position from the pressures of eruption made by the permanent first premolar and canine [4, 28]. The arch form and symmetry and dental alignment are usually restored [10], as happened in our case.

If the transposition is complete, meaning that the roots and the crowns of the affected teeth have switched places, there is a high risk of damaging the tooth structure or the supporting tissues, like the bone or the gingiva, and the treatment time is longer [4]. When choosing the treatment protocol, there are several factors that need to be evaluated: age of the patient, type of transposition (complete or incomplete), dental morphology, stage of the root development, position of the crowns and roots, bone thickness at the level of the transposition, tissue alterations, aesthetics, and occlusion [2, 15, 26]. There are several authors that suggest keeping a complete transposition after the eruption of the teeth; for example, Peck *et al.* encourage orthodontic treatment only for incomplete transpositions, due to the complex biomechanics [1]. The width of the bone is insufficient to allow the bypassing of the erupted adjacent teeth when a complete transposition is present, so the integrity of the tissues might be affected [6].

If we speak only about the mandibular transposition between lateral incisor and canine, and this one is incomplete, it can be usually treated orthodontically, meaning the teeth will be aligned in their natural position. The needed space will be obtained by temporary teeth removal, and rotations and tipping corrections will be made for the permanent teeth [29]. On the other hand, if the transposition is complete and the lateral incisor and canine have switched places, the zone is not of major aesthetic concern, but rather of functional concern, so it is not advised to correct the transposition. The teeth are rather kept in place and are further reshaped, or if there is insufficient space, one of them, if extracted, most frequently the lateral incisor [8, 18].

Several orthodontic methods, like segmented or full arch appliances are available and recommended for tooth alignment, and each time the mechanics must be individualized for each patient [30]. Shapira & Kuftinec suggested as a key factor in dealing with the lateral incisor–canine malocclusion the intrabony position of the canine, meaning its pre-eruptive progress inside the basal bone, in strong relation with the age [21]. In the case presented

above, the canine did not erupt and had a low position inside the mandible, making the case a good candidate for normal teeth alignment. Another important aspect when trying to properly position a displaced canine is the anchorage. It depends on the teeth that are already erupted, the position of the transposed teeth, the periodontal status [30]. In our case, brackets were placed on both permanent and temporary teeth, and active traction was applied at the beginning of treatment only on the lateral incisor, while passive traction with only arch wire guidance was performed during the canine eruption, after its surgical exposure. In more difficult cases or when insufficient teeth are present for anchorage, if needed, skeletal anchorage can be used to facilitate the orthodontic movements [31].

Conclusions

In the case presented here, the biomechanics that were used on a fixed orthodontic appliance allowed the repositioning of the lateral incisor to its normal position, without interfering with the dental tissue's integrity and path of eruption of the canine. Although the mandibular lateral incisor–canine transposition does not happen as often as the maxillary one, when this anomaly is discovered, early intervention is mandatory. These teeth are in the aesthetic zone, influencing the appearance, and also take part in the functionality of the mandibular movements. The ability to move the canine in its correct position, as successfully performed in this case, ensures a good long-term prognosis.

Conflict of interests

The authors declare that there is no conflict of interests.

Authors' contribution

Oana Cella Andrei and Mirela Ileana Dinescu equally contributed to this article.

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