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Clinical case

Correction of a Complete Bilateral Transposition of Upper Canine-First Premolar with Severe Crowding

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Abstract

Introduction: Dental transposition is a difficult anomaly to be treated in the orthodontic practice. It can be defined as a position exchange of two adjacent teeth in the dental arch. **Objective:** To correct the transposition between upper canines and first premolars, eliminating the severe upper and lower crowding, and correcting overjet and overbite. **Case presentation:** A 15-year-old male patient came to the orthodontics clinic showing a dolichofacial skeletal Class II, molar class I, and non-established canine class; a complete bilateral transposition of the upper canine-first premolar and severe upper and lower crowding. The upper and lower first premolars were extracted, and fixed metal appliances were bonded (MBT slot 0.022"). Open coils between upper second premolars and canines were used to mesialize the canines to obtain a Class I relationship. The canines were moved to a class I relationship; correct overbite and overjet were achieved and crowding was eliminated giving a functional occlusion. **Conclusion:** An accurate diagnosis and treatment plan makes it possible to provide a stable and functional occlusion to patients.

Keywords: dental transposition, canine-first premolar transposition, dental eruption anomalies.

INTRODUCTION

Dental transposition is a rare oral problem defined as an alteration in dental eruption where there is a position exchange between two adjacent teeth in the arch[1]. It represents a multifactorial condition, its etiology is due to the presence of genetic or environmental factors, or a sum of both[1,2]. Environmental factors such as arch discrepancy, dental alterations (caries, periodontal problems, abnormal root resorption), and dental trauma are factors that can contribute to ectopic eruption of the canine[1].

Transposition is divided into two types: complete and incomplete. In incomplete transposition, the involved teeth present transposed crowns and root apices in their correct original positions. In the complete transposition, the teeth have completely exchanged apices and crowns, and in some cases the teeth are parallel[3].

The prevalence of dental transposition is approximately 0.4%-0.5%, it occurs more frequently in the maxilla than in the mandible, and the maxillary permanent canine is the most frequently involved[3,4]. It is commonly accompanied by peg-shaped lateral incisors and occurs most frequently in the canine and upper first premolar area[4]. It has been reported in males and females, with a prevalence in the female gender and a higher frequency on the left side of the patient's arch.[5-7] Peck and Peck[8] reported a prevalence for the canine and upper first premolar of 71%, for the canine and lateral incisor of 20%, and for the canine and first permanent molar, canine-lateral and central incisor, canine and central incisor of 9%.

Dental transposition causes crowding of the teeth and esthetic and functional problems. An early diagnosis can be made between 6 and 8 years of age with an orthopantomography. When the alteration is detected early, interceptive procedures can be performed such as extraction of the deciduous tooth or placing eruption guides for the permanent tooth, preventing the full development of the anomaly. When detected late, they should be addressed with a treatment plan that involves the status of the entire dentition[5].

Treatment alternatives vary from premolar extraction, prosthodontic rehabilitation without orthodontic intervention, or even orthodontic treatment either correcting the problem or aligning the alteration (accepting dental transposition)[9]. Other options include extraction of the transposed tooth and then placing an implant or surgical repositioning of the tooth[10].

Attempting to correct the tooth order in a tooth transposition can lead to gingival recession with loss of periodontal support, prolonged treatment time, and root resorption. However, the possibility of correcting the order is greater in the maxilla than in the mandible because of bone density and labio-lingual bone boundary. On the other hand, on some occasions, it is recommended to maintain the canine-premolar transposition due to the similarity of the crowns. When the transposition is incomplete, the correction of the dental order can be performed without compromising the duration of the treatment, and acceptable esthetic results are achieved. It is for this reason that the initial position of the apexes of the involved teeth is essential to define the treatment[5].

The following is an orthodontic treatment in which a complete bilateral upper canine-first premolar transposition with severe upper and lower crowding was corrected.

CLINICAL CASE PRESENTATION

Male patient, 15 years old, with the reason for consultation "*I have crooked teeth*". In the extraoral analysis, the patient presented a severe dolichofacial pattern, oval face, convex profile, large nose, medium smile, 40% upper incisor display and 100% of the lower incisors; narrow buccal corridors, enlarged lower third, acute nasolabial angle. The upper dental midline was deviated 1 mm to the right with the facial midline (Figure 1.A). Intraoral analysis showed mixed dentition, molar class I, unestablished canine class, triangular-shaped dental arches, irregular gingival margins, non-coincident dental midlines, posterior crossbite located in the first permanent molars and second upper premolars, 3 mm overjet, and 4 mm overbite, bilateral transposition of maxillary permanent canines with first premolars, over-retained upper primary canines, palatally-displaced upper second premolars with mesial rotations and the right upper lateral incisor in labial ectopic position; severe upper and lower crowding with a significant osseo-dental discrepancy. Caries in upper left first molar, lower left first molar, and lower right first molar, periodontal and functional health (Figure 1.B). In the study models we observed a Spee curve of 4mm, and a discrepancy of -18mm in the upper arch and -14mm in the lower arch.

The orthopantomography confirmed the bilateral complete dental transposition of the canines with the upper first premolars, the presence of upper and lower third molars as well as the upper primary canines. A good crown-root ratio, permeable airways, and condylar symmetry were noted (Figure 1.C). The lateral head film showed a clockwise rotation of the mandible and increased lower facial height (Figure 1.D). Steiner's analysis was performed with Dolphin Imaging Software version 9.0.00.19®, resulting in a skeletal Class II due to maxillary protrusion and mandibular posterior rotation ANB: 8°. SNA: 87°. SNB: 79°. Vertical growth SN-GoGn: 40°. Vert -2 (severe dolichofacial) (Table 1).

The facial objectives of the treatment were to decrease facial convexity, improve the profile and the smile while maintaining the height of the lower facial third. The dental objectives included eliminating crowding, placing canines in the proper position in the arch eliminating transposition, establishing canine class I and maintaining molar class I, eliminating posterior

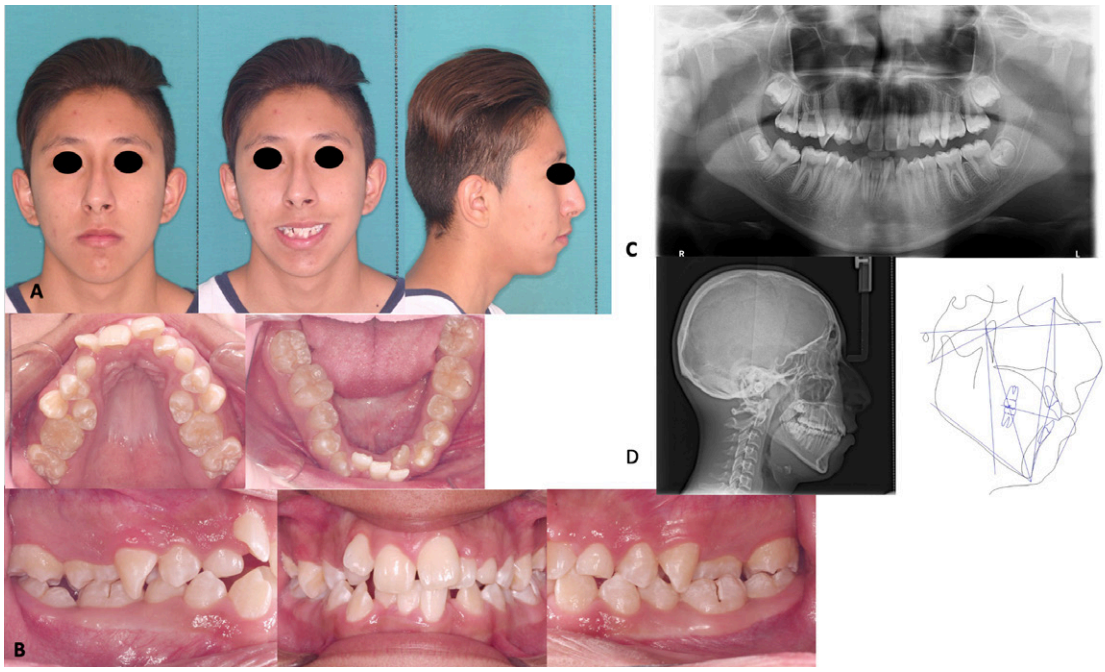

Figure 1. Initial photographs and radiographs. A. Extraoral photographs of the frontal view, smile and profile. B. Intraoral photographs. Complete bilateral transposition of the upper canines with first premolars, severe upper and lower crowding, posterior crossbite of permanent first molars, mesially rotated second premolars and temporary upper canines present. C. Orthopantomography. D. Lateral head film with the initial Steiner cephalometric tracing.

crossbite of first molars and upper second premolars, coordinating arches, eliminating the curve of Spee, matching dental midlines, maintaining periodontal health, and obtaining normal overjet and overbite.

Table 1. Cephalometric values of pre- and post-treatment Steiner analysis.

	STEINER		
Measurement	**Mean. Standard Deviation**	**Patient Initial**	**Patient Final**
SNA	80(+/-1)	87°	85.5°
SNB	78(+/-1)	79°	79.8°
ANB	2	8°	5.7°
GO GN SN	32°	40°	40.5°
PlO/ S-N	14°	18°	14°
1 U -SN	103°	105°	111°
1U/1L	135.4°(+/-5.8)	128°	122°
1U-Na °	22°	19°	25.7°
1U-NA mm	4mm	3mm	1.7mm
1L-NB °	25°	28°	25.7°
1L-NB mm	4mm	10mm	6.9 mm
IMPA	90°	82°	85.4°
Lower lip/ E Plane	-2mm	4.2mm	0.6mm

The patient was referred for the extraction of the upper and lower first premolars and upper primary canines to make space in the arches for dental alignment and leveling. 0.022" metal MBT appliances were cemented with initial 0.012" NiTi upper and lower archwires. We advanced to upper and lower 0.014" NiTi archwires and in the upper arch we placed open springs from the upper first molars to canines to mesialize them (Figure 2. A). Upper and lower 0.016" stainless steel (SS) archwires were placed with stops in the upper arch as anchorage of the molars. A ligature block of the four upper incisors was placed as anchorage and elastic chains to the upper canines to complete the canine mesialization towards class I. When the canines were brought to their position, a block was placed from the upper right canine to the upper left canine with ligature and in the lower arch in the same way from the lower right canine to the lower left canine. The extraction spaces in the lower arch were consumed by eliminating the crowding. In the upper arch with a 0.019" x 0.025" NiTi archwire, a couple was made to correct the rotations of the upper second premolars (Figure 2. B). The activation of the couple was maintained until these teeth were aligned. Tubes were placed in upper second molars and a 0.016" NiTi thermal arch including the upper second premolars to the arch for re-leveling. Similarly, tubes were placed in lower second molars and a 0.016" thermal archwire. Then 0.018" NiTi, 0.016 x 0.022" NiTi, and 0.016 x 0.022" SS upper and lower archwires were placed. The crossbite of the upper first molars and second premolars was corrected with arch form both in the alignment and leveling phase and with the rigid SS archwires. An orthopantomography was obtained for the root parallelization stage and 3/16 4.5 oz settling elastics were indicated with a class II vector for 3 months (Figure 3). For retention, a lower fixed retainer was placed from canine to canine, and a 0.060"-gauge occlusal guard in the upper arch.

Among the facial results, facial convexity was reduced, the profile and smile were improved, and the lower facial height was maintained according to the objectives (Figure 4.A). Regarding the dental results, canine class I was achieved, molar class I was maintained, and the crossbite of the first molars and second upper premolars were corrected. Normal overjet and overbite were obtained. The crowding was eliminated thanks to the extractions of the first premolars, the transposition of the canine was also solved, and the dental midline was corrected (Figure 4.B).

The orthopantomography showed parallel dental roots, good crown-root ratio, and impacted lower third molars (Figure 4.C). The superimposition showed that the patient's ANB angle was reduced improving his skeletal relationship and good control of the patient's vertical growth was maintained (Figure 4.D). Finally, the patient was referred to the prosthodontic area to eliminate the caries lesions in his dental organs and to maxillofacial surgery for the extraction of the upper and lower third molars.

DISCUSSION

The correction of the complete bilateral upper canine-first premolar transposition of the present clinical case was successfully performed in 36 months. The mechanics focused on the mesialization of the canines to the extraction space of the upper first premolars, these extractions were indicated due to the crowding that the patient presented. However, it is important to comment that treatment time was extended a little longer due to the mechanics necessary to mesialize the canines bodily and then align the rotated upper second premolars. In contrast to the clinical case presented here, a case reported by Lorente *et al.*[10] corrected the

Figure 2. Sequences of the alignment and leveling phase. A. Placement of upper and lower fixed appliances with the MBT system. Extractions of the first four premolars can be observed, as well as the placement of active open coils from upper first permanent molars to canines to mesialize them and bring them to their correct position. Also, the progression of the mechanics to bring the upper canines to their correct alignment with the use of open coils. To finalize the closure, elastomeric chains from lateral incisors to upper canines were used. B. The sequence to eliminate the rotation of second premolars with the use of couples supported on upper permanent canines and first molars is observed.

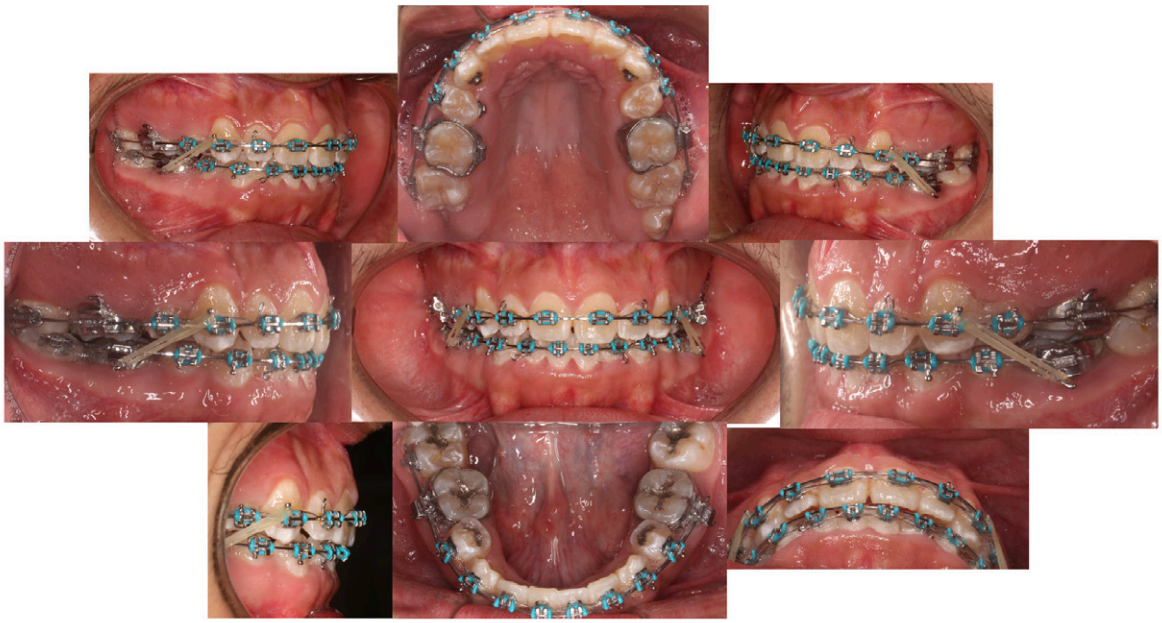

Figure 3. Treatment progress. The use of class II elastics was indicated to obtain canine guidance and improve posterior settling.

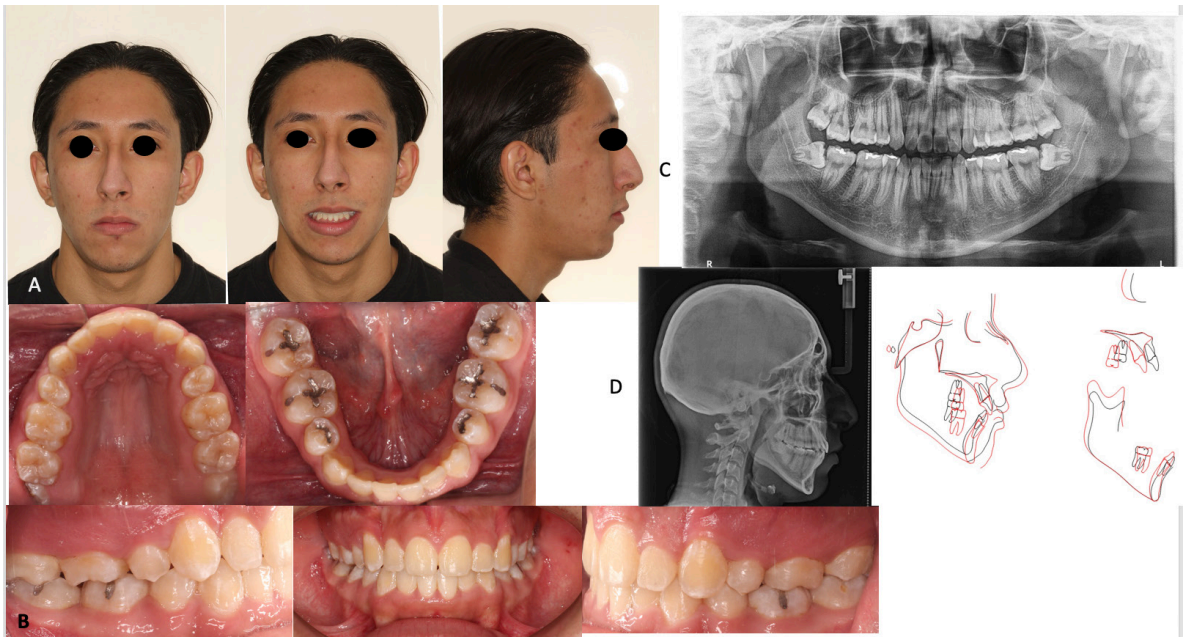

Figure 4. Final photographs and radiographs. A. Extraoral photographs of frontal view, smile and profile. B. Intraoral photographs showing the correction of the dental transposition, eliminated crowding, normal overjet and overbite, canine and molar class I, posterior settling, periodontal health. C. Orthopantomography where the parallel roots of the dental organs are observed. D. Lateral head film and tracings, where the teeth axial axes are observed in their bony bases as well as the patient´s harmonic profile and the superimposition of the initial and final radiographs of the treatment.

dental transposition of the upper canine-first premolar without the need for extractions of the first premolars because there was no significant crowding in that patient.

Orthodontic correction of dental transposition is considered a very complex and risky treatment that can cause damage to neighbor teeth or supporting structures[11]. In the present case, we decided to correct the dental transposition because of the occlusal advantages of canine guidance and the good esthetic appearance of the patient. As reported in an article by Lee *et al.*[12], even in facial esthetics the canine elevation provides nasolabial support, which helps the patient to have a better appearance during aging. It is important to mention that the low incidence and prevalence of dental transposition is a major reason why there are few studies to help determine the most effective treatment alternative. In the literature, we can frequently find the alternative of accepting and leaving the dental transposition, or otherwise extracting one of the teeth involved in such transposition, as we did in this case[13].

When correction of the transposition is decided, some aspects that should be considered are the position of the crown and root within the alveolar process in the three planes of space, the degree of risk of root resorption of the teeth involved, the malocclusion of the patient, the experience of the professional and the motivation of the patient[14]. It is mentioned that the less the canine has descended to its position in the alveolar bone, the more it favors the movement of this tooth because the alveolar process is thicker in the upper part[15]. In a study by Matsumoto *et al.*[16], they present the clinical case of a patient with complete transposition of the upper right central canine-incisor. They decided to extract the lateral incisor because the orthodontic correction involved a high risk of root resorption, and the arch length discrepancy was unfavorable for the patient. This decision to extract a tooth shows a similarity to the patient

presented in this article, because both cases presented negative arch length discrepancies, so we resorted to the extraction of one of the teeth involved.

When the transposition is complete, the idea of repositioning the affected teeth in the arch is complex, because it can cause damage to the supporting tissues. The option of extracting the premolar is a better alternative, especially if the teeth affected by the transposition present caries lesions or little periodontal support tissue, or also when they present a negative or severe bone-tooth discrepancy and a convex profile[17].

CONCLUSION

Dental transposition can be successfully corrected as long as a good diagnosis and treatment plan are performed, and dental movements are very well controlled. The biological limits of the dental and periodontal tissues should always be considered for the treatment of transposition and to avoid the negative effects that may develop.

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