European Journal of Musculoskeletal Diseases
ISSN 2038-4106/2022

Case report

ORTHODONTIC MANAGEMENT OF MAXILLARY TOOTH TRANSPOSITION: A CASE REPORT

A. Fiori[1], R.P. Rotolo[1], B.M. Strangio[1], K. Ferati[2], A. Palermo[3], A. Mancini[4*], E. Xhajanka[5], B. Sayahpour[6] and A. Jamilian[7]

[1] Multidisciplinary Department of Medical-Surgical and Dental Specialties, University of Campania Luigi Vanvitelli, Naples, Italy;
[2] Faculty of Medicine, University of Tetovo, Tetovo, Macedonia;
[3] College of Medicine and Dentistry, Birmingham, UK;
[4] Interdisciplinary Department of Medicine, University of Bari "Aldo Moro", Bari, Italy;
[5] Medical University of Tirana, Rruga e Dibrës, Tirana, Albania;
[6] Department of Orthodontics, Johann-Wolfgang Goethe University, Frankfurt, Germany;
[7] Department of Orthodontics, Dental School, Cranio Maxillofacial Research Center, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.

**Correspondence to:*
Antonio Mancini, DDS
Interdisciplinary Department of Medicine, University of Bari "Aldo Moro", 70121 Bari, Italy
e-mail: dr.antonio.mancini@gmail.com

ABSTRACT

Transposition is an exchange of the position of two adjacent teeth, which can be incomplete or complete. The aim of this case report was to illustrate the non-extraction treatment of transposition between maxillary canine and first premolar using multibrackets fixed appliance. The treatment of this anomaly varies from acceptance to correction and should consider several aspects such as age, dental morphology, malocclusion, facial esthetics, stage of root development, the position of the root apices, and magnitude of the transposition. The patient, a boy, aged 11 years, had a class III malocclusion with narrow maxillary arch, crossbite from 1.2 to 1.5 and 2.2, with transposition of 2.3. The early diagnosis plays a significant role in considering esthetics and functional factors in deciding which treatment strategy should be followed to promote the patient's self-esteem. The key to a successful and stable result is precise treatment planning and careful orthodontic management.

KEYWORDS: *tooth, transposition, treatment, orthodontics, surgery*

INTRODUCTION

Dental transposition is the interchange of the position between two teeth, which can be incomplete or complete (1). In

Received: 02 august 2022
Accepted: 11 october 2022

ISSN: 2038-4106

the complete one, both the crowns and the entire root structures are parallel in their transposed positions. The crowns may be transposed in the incomplete transposition, but the roots remain in their regular positions (2). The prevalence of transposition is about 0.5% in the general population and presents no gender predilection (3, 4). Transposition can appear in both the maxilla and the mandible. However, it is more frequent in the maxilla than in the mandible and more unilaterally than bilaterally (5–8).

In the upper arch, the most frequent transposition is between the canine and the first premolar. On the contrary, the most common transposition in the lower arch is between the canine and the lateral incisor.

Transposition is characterized by a multifactorial etiology that is not entirely understood nowadays. Several theories have been proposed to explain this condition. Multifactorial genetic factors such as the inversion of the position of the dental lamina of the teeth involved have been suggested as one of the causes, as supported by Peck, et al. (9) and Nelson (10). Additionally, environmental factors such as deciduous trauma, retained deciduous whose roots can cause mechanical interference on the permanent teeth, severe rotations, malformation of adjacent teeth, dental malposition, the supernumerary teeth and the lacerations, can as well contribute to its establishment (6–8, 11).

A correct diagnosis is the basis of an effective treatment plan. It is necessary to identify the anomalous position of the dental elements and to evaluate their relationship with the adjacent anatomical structures and the possibility of recovery. The first level radiographic exam for a preliminary assessment is the panoramic x-ray. However, only the CT/Cone Beam can provide images useful for the evaluation of the 3D position of the affected roots, bone defects, and the involvement of the nearby structures (12–15).

The decision on whether to keep or correct the transposed teeth is crucial to the treatment planning for transposition and depends on various factors such as patient's age, diagnosis, teeth involved, degree and extent of transposition(16).

From an orthodontic perspective, the treatment can be performed by extraction or non-extraction. In the non-extraction option, the transposed teeth are aligned in their normal or transposed positions (12–15).

Generally, in medicine, it is mandatory to consider several approaches after formulating a correct diagnosis and then monitor the treatment results and their efficacy compared to other approaches used in similar clinical cases. Specifically, evaluating the advantages and disadvantages of these patients' two main treatment options remains necessary. The most significant advantages from an aesthetic and functional point of view are obtained by repositioning the affected dental elements. However, this option is not always possible considering the complications of the biomechanics and the risk of resorption of the adjacent bone structures, root resorption, and treatment time.

This case report demonstrates the management of a young patient's maxillary tooth transposition, canine-first premolar.

CASE REPORT

Diagnosis and etiology

A male patient aged 11 years and came to the Orthodontic Program with his parents complaining of an ugly smile. He did not report any previous orthodontic treatment or trauma history. Extraoral examination revealed a symmetrical face, decreased lower facial height with a concave profile, increased Z angle, and accentuated labiomenton groove. Intraoral examination revealed a molar class III relationship bilaterally. The maxillary left permanent canine was partially erupted in an ectopic position, buccally to the first premolar. He had widespread diastemas, crossbite from 1.2 to 1.5 and 2.2, with overbite and overjet of 0 mm (Fig. 1). The panoramic x-ray showed an incomplete transposition of the crowns and the roots of the maxillary left canine (2.3) and the first premolar (2.4).

The lateral cephalometric analysis revealed that in this patient, there was a skeletal class III relationship (ANB angle = -1,5°) with upper and lower incisors compensation. In addition, the Cervical Vertebral Maturation (CVM) and the hand-wrist radiography (HWR) indicated that the patient was in the pubertal peak phase.

Treatment objectives

The main goal was to control the skeletal class III relationship and to achieve aligned and leveled teeth without compromising soft tissue and periodontal structure. For this reason, the treatment objectives were to improve the skeletal and molar class III relationships, achieve a functional molar occlusion, correct the transposition, maintain or improve overjet and overbite, and maintain the upper and lower incisor compensation. Based on the patient age and diagnosis, the best treatment option was an interceptive treatment with the following orthodontic correction treatment of the transposition. The interceptive treatment was carried out with a modified SEC III protocol with a rapid palatal

Fig. 1. *Pretreatment extraoral and intraoral photographs.*

Fig. 2. *Modified SEC III protocol.*

expander (RPE) on four bands, a lower splint with class III elastics, and a chin cup (Fig. 2).

In the second phase, 7-7 upper and lower multibracket fixed appliances were used in the upper and lower arches.

Treatment progress

The first phase of treatment involves the modified SEC III protocol with:

- rapid palatal expander on four bands with arms extended up to the canines, with auxiliary eyelets to help cuspid reposition;
- lower splint with class III elastics;
- chin cup with a bilateral force equal to 450gr/side (16 oz) (Fig. 2).

The deciduous canines were extracted (5.3 and 6.3). The upper and lower arches were fully bonded with 0.022″ × 0.028″ MBT fixed appliances.

A sectional archwire 0.16x0.22 SS with contact omega loops and an open vertical loop for 2.3 mesialization were inserted (Fig. 3).

After a new sectional 0.16x0.22, SS with contact omega loops and an open vertical multi-loop for the mesialization of the 2.3 was applied (Fig. 4).

When 2.3 reached its correct position, we began repositioning 2.4 in the arch. In the upper arch, a .016 AA wire with two contact omega loops on 1.6 and 2.6 was positioned, with a Niti coil spring between 2.2 and 2.4 to gain space for 2.3 and to center the upper median. After, .017 × .025 Nickel-Titanium and .019 × .025 stainless steel wires were used in the upper and lower arches with class III elastic (1/4 oz per side) and the chin cup (for the mandibular control). After 36 months of active treatment, the maxillary and mandibular fixed appliances were removed, and the post-treatment records were taken to assess whether the treatment objectives were fully achieved.

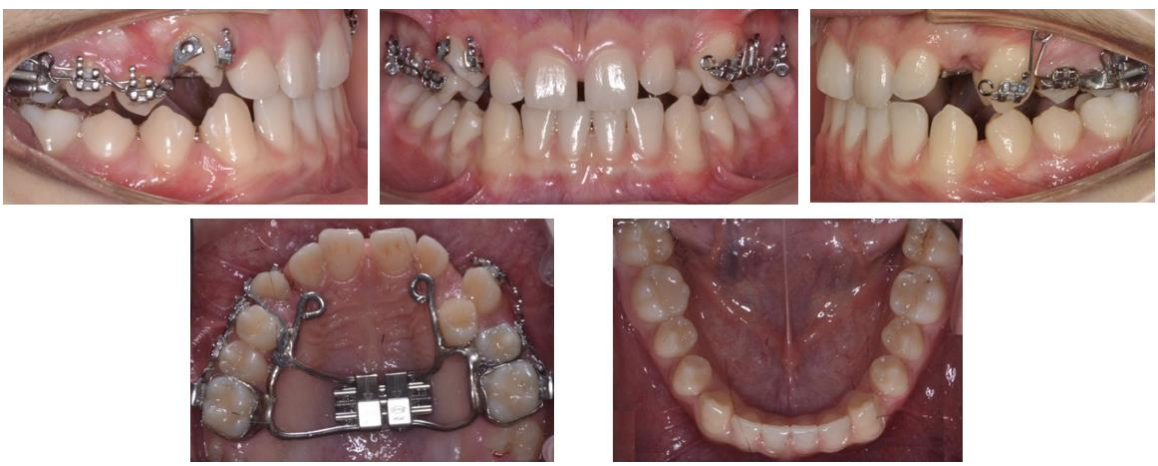

Fig. 3. *0.16x0.22 SS with contact omega loop and an open vertical loop.*

Fig. 4. *Activation of the open vertical multi-loop.*

RESULTS

The treatment goals were correctly achieved, supporting and complementing the already published scientific information (15, 16). The skeletal relationship was controlled with a nice facial profile (Fig. 5). The occlusal, functional, and esthetic results were satisfactory; therefore, the patient and his family were happy with his smile. The patient presented class I molar and canine relationship and good intercuspation. All maxillary spaces were closed. The upper and lower dental midlines were coincident with good overjet and overbite. From a periodontal point of view, all the upper and lower teeth were well-positioned with no supporting dental tissue complications. The end-treatment panoramic x-ray showed that all roots were in good parallelism. The patient was also fully satisfied with the results.

DISCUSSION

Dental transposition is one of the foremost challenging conditions in orthodontics, betting on which teeth are involved and their positions relative to the adjacent teeth.

The treatment strategy of transposition should be individual by considering various factors such as the patient's age, diagnosis, teeth involved, and degree and extent of transposition. For the observed transposition, many treatment modalities have been proposed in the literature depending on the degree of difficulty and age of the patient: (1) extraction of one of the transposed teeth that would reduce the time of treatment and make the correction easier; (2) non-extraction treatment including two different alternatives maintaining the transposed order or correcting the transposition. This case report decided to correct the transposition to obtain an ideal functional and aesthetic result. One of the main purposes was the control of the angulation and torque of the root of the first premolars and canines.

This therapeutic approach has certain limitations (17), for example, the role of periodontal inflammation in type 2 diabetes mellitus. This work presents a case report with a longer treatment duration (3 years) than usual orthodontic treatment, but this option should guarantee a symmetrical outcome without needing future restorative procedures.

CONCLUSIONS

Dental transposition is a very challenging condition in terms of precise planning and management. The early diagnosis plays a significant role in considering esthetics and function factors to decide which treatment strategy should be followed. Therefore, treatment planning and well-designed treatment mechanics are mandatory, together with good finishing, to achieve a successful and stable result.

Fig. 5. *Post-treatment records.*

REFERENCES

1. Capelozza Filho L, Cardoso MA, An TL, Bertoz FA. Maxillary Canine—First Premolar Transposition. *The Angle Orthodontist*. 2007;77(1):167-175. doi:10.2319/012906-32r.1
2. Mereani S, Alotaibi A, Bokhari A. Orthodontic Management of a Rare Incidence Bilateral Maxillary Canine-First Premolar Transposition Using Fixed Appliance. Gavião MBD, ed. *Case Reports in Dentistry*. 2022;2022:1-10. doi:10.1155/2022/9973333
3. Finkelstein T, Shapira Y, Pavlidi AM, et al. Canine Transposition - Prevalence, Distribution and Treatment Considerations among Orthodontic Patients. *The Journal of Clinical Pediatric Dentistry*. 2020;44(4):268-273. doi:10.17796/1053-4625-44.4.9
4. Sabri R, Zaher A, Kassem H. Tooth transposition: a review and clinical considerations for treatment. *World Journal of Orthodontics*. 2008;9(4):303-318.
5. Nishimura K, Nakao K, Aoki T, Fuyamada M, Saito K, Goto S. Orthodontic correction of a transposed maxillary canine and first premolar in the permanent dentition. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;142(4):524-533. doi:10.1016/j.ajodo.2011.01.027
6. Shapira Y, Kuftinec MM. A unique treatment approach for maxillary canine-lateral incisor transposition. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2001;119(5):540-545. doi:10.1067/mod.2001.111221
7. Grassia V, D'Apuzzo F, Ferrulli VE, Matarese G, Femiano F, Perillo L. Dento-skeletal effects of mixed palatal expansion evaluated by postero-anterior cephalometric analysis. *European Journal of Paediatric Dentistry*. 2014;15(1):59-62.
8. Shapira Y, Kuftinec MM. Maxillary tooth transpositions: Characteristic features and accompanying dental anomalies. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2001;119(2):127-134. doi:10.1067/mod.2001.111223
9. Peck L, Peck S, Attia Y. Maxillary canine-first premolar transposition, associated dental anomalies and genetic basis. *The Angle Orthodontist*. 1993;63(2):99-109.
10. Nelson GC. Maxillary canine/third premolar transposition in a prehistoric population from Santa Cruz Island, California. *American Journal of Physical Anthropology*. 1992;88(2):135-144. doi:10.1002/ajpa.1330880203
11. Nabbout F, Skaf Z, Hlayhel J. Maxillary tooth transposition: A report of two cases. *International Orthodontics*. 2017;15(3):467-482. doi:10.1016/j.ortho.2017.06.023
12. Kapila SD, Nervina JM. CBCT in orthodontics: assessment of treatment outcomes and indications for its use. *Dentomaxillofacial Radiology*. 2015;44(1). doi:10.1259/dmfr.20140282
13. Matsumoto MAN, Stuani MBS. Tooth transposition: a multidisciplinary approach. *Dental Press Journal of Orthodontics*. 2018;23(1):97-107. doi:10.1590/2177-6709.23.1.097-107.bbo
14. Raucci G, Elyasi M, Pachêco-Pereira C, et al. Predictors of long-term stability of maxillary dental arch dimensions in patients treated with a transpalatal arch followed by fixed appliances. *Progress in Orthodontics*. 2015;16(1). doi:10.1186/s40510-015-0094-9
15. Scarano A, Tartaglia G, Rapone B, Inchingolo F, Lorusso F. Maxillary Sinus Osteoma as a Support for Dental Implant Associated to Sinus Augmentation Procedure: A Case Report and Literature Review. *Applied Sciences*. 2022;12(11):5435. doi:10.3390/app12115435
16. Scarano A, Conte E, Mastrangelo F, Greco Lucchina A, Lorusso F. Narrow single tooth implants for congenitally missing maxillary lateral incisors: a 5-year follow-up. *Journal of Biological Regulators and Homeostatic Agents*. 2019;33(6(S2)):69-76.
17. Di Venere D. Early mandibular canine-lateral incisor transposition: case report. *Oral & Implantology*. 2017;10(2):181. doi:10.11138/orl/2017.10.2.181