
TOOTH TRANSPOSITION - CLINICAL CONSIDERATIONS

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Abstract:

Transposition is a rare anomaly associated with a change in the location of two teeth, as the order of two adjacent teeth is interchanged in the dental arch. Its frequency in the Bulgarian population is 0.96%.

Material and method: Two clinical cases of 9- and 11-year-old children with transposition, treated with different orthodontic approaches, are described. Complete documentation describing clinical findings and treatment is provided: Intraoral photographs, panoramic radiographs and cone beam computer tomography.

Aim: The aim of the paper is to present and critically discuss various treatment methods of dental transposition, their advantages and disadvantages.

Result: Positioning of the teeth in the upper dental arch as well as correction the bite, were achieved in both cases. From a functional point of view, the contact points between the posterior teeth in both jaws have been restored. The gingival levels of the canines and premolars are preserved. The position of the premolar has been changed so that it resembles a canine as much as possible from an aesthetic point of view.

Conclusion: Upper canine and first premolar transposition can be successfully treated with early diagnosis and orthodontic planning of tooth movements.

Key words: Tooth transposition, Treatment approach; Orthodontic diagnostics

INTRODUCTION

Transposition is an abnormality in the arrangement of teeth, in which two adjacent teeth are interchanged in the dental arch [1, 2]. The true form is considered when the crown and root of the adjacent teeth are repositioned and are parallel to the other teeth. Dental transposition is incomplete (pseudotransposition) when the crowns are in swapped positions, but the roots (most often their apical part) are not [1, 3]. In reality, the incomplete form is a manifestation of ectopy, due to disturbances in the

eruption of the teeth. The eruption path can be changed due to the presence of mechanical obstruction, such as odontoma, supernumerary teeth, cysts, dilacerations of roots of adjacent teeth and others. The phenomenon of transposition can be observed in both arches, but the upper jaw is more often affected. It has been proven that dental anomalies in the upper jaw occurred more often than those in the lower jaw due to the more complex structure of the bone and its close interaction with other cranial structures [4]. Tooth transposition has no sex preference, could be seen bilaterally or unilaterally, but unilateral was observed more often [5-7].

Tooth development is a complex process carried out under strict molecular and genetic control. Specific genetic factors are responsible for the development of dental anomalies in each jaw [4]. The inversion of the position of the tooth buds within the dental lamina would initiate dental transposition [8]. General changes in the genesis of teeth have reflected on the simultaneous development of various forms of dental anomalies [5]. Biological phenomena, most frequently connected with transposition, are hypodontia, microdontia and hyperdontia, ankylosis of temporary teeth or severe rotation of permanent teeth [9, 10].

This positional deformity is relatively rare. Values from 0.2% to 1.5% are described in the scientific literature, depending on the studied contingent [1,11-13]. Studies among Bulgarian orthodontic patients reported a frequency of 0.96% [3]. The most affected tooth by transposition is the canine [14]. It exchanges its position with the lateral incisor or first premolar, and in casuistic cases with the central incisor. The most predisposing factor of the canines' migration is their long eruptive path. Transposition of an upper canine with a first premolar [3, 12, 14, 15] followed by an upper canine – lateral [16] are most often described in the literature. Tooth transposition creates significant aesthetic and functional problems in both jaws. In these cases, there are several treatment options: tooth extraction if the degree of crowding is appropriate, surgical repositioning, a surgical-orthodontic approach to reposition and correct the transposition, or orthodontic treatment that leaves the teeth exchanged.

The aim of the paper is to present various treatment methods of dental transposition, their advantages and disadvantages.

MATERIAL AND METHODS

We will critically describe and discuss two clinical cases of transposition treated with different approaches. Patients and parents accepted the orthodontic treatment plan and signed an informed consent. They have clearly given their consent to the use of treatment information for scientific purposes, without revealing their identity.

Clinical case 1

We present a clinical case of a 9-year-old patient with transposition of an upper left canine and premolar. The dental anomaly was stated by an incidental radiological x-ray during a prophylactic orthodontic examination in the mixed dentition period. Parents' concerns are about the position of the upper incisors.

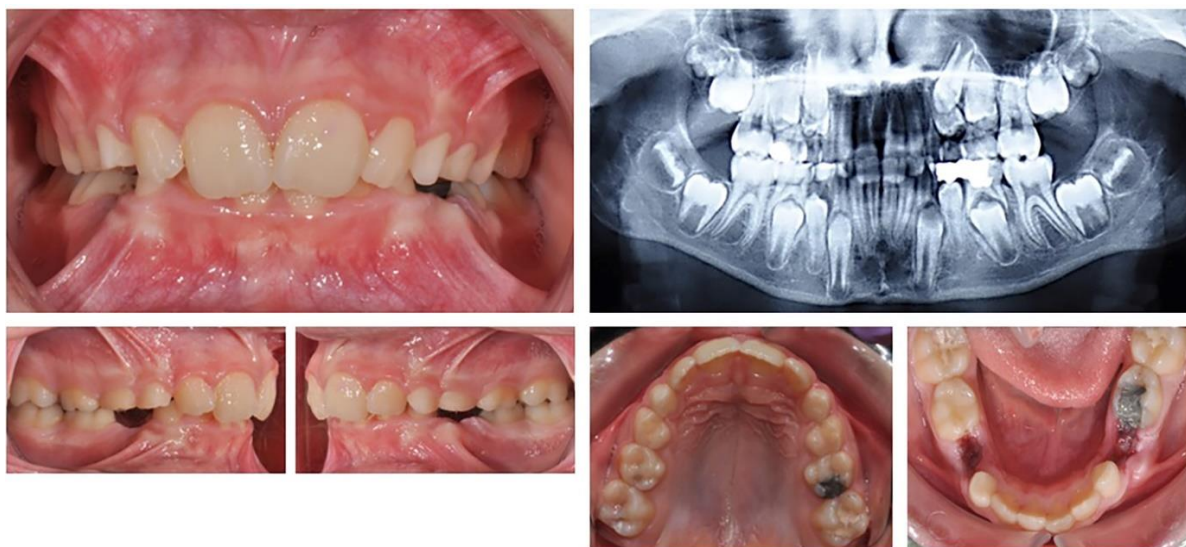


Figure 1: Intraoral image and X-ray at primary orthodontic examination.

Orthopantomography revealed a true form of transposition between the upper left canine and first premolar [24-23]. The position of the canine root was high and distally placed, while the root of the premolar was medially inclined (Fig. 1). This topography is not favorable for treatment planning with repositioning of both teeth. The parents are aware of the risk of orthodontic treatment associated with changing of the positions of the two teeth (root resorption during palatal displacement of the premolar

and its distal inclusion in the arch and the possibility of recession in canines due to its movement near the buccal compacta). After discussing the treatment options, they chose to treat sequentially premolar-canine-premolar and achieve therapeutic occlusion. A treatment plan was developed that included preserving the perimeter of the upper dental arch and early extraction of upper primary canines and molars. Tracking the eruption of permanent canines and premolars and their leveling in the dental arch.

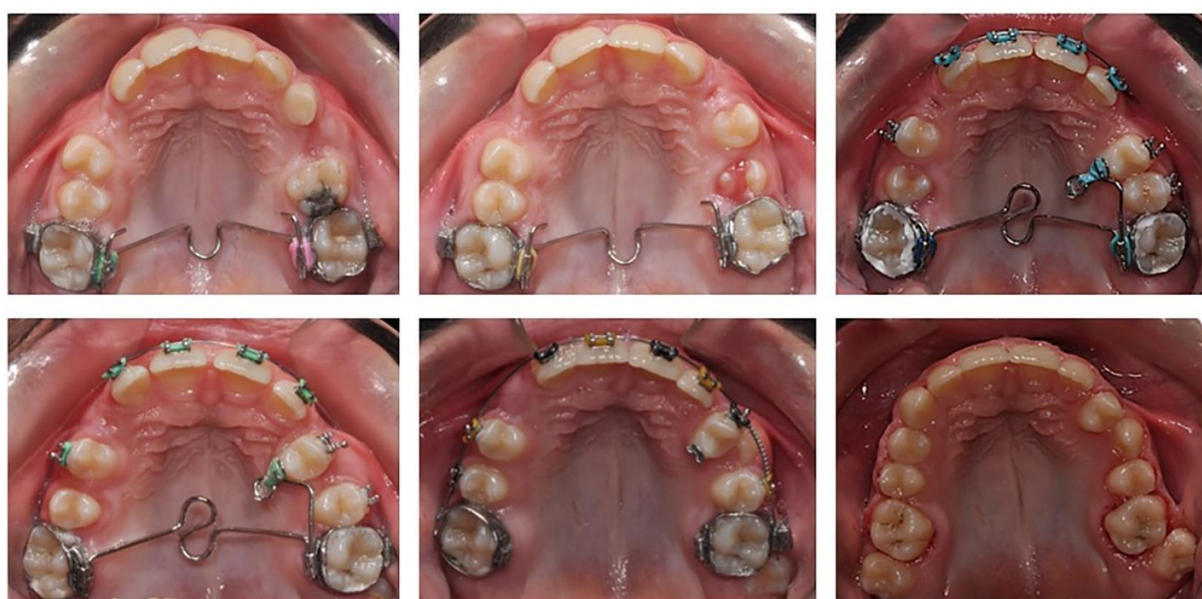


Figure 2: Follow-up of upper permanent canines and premolars eruption and treatment phases

A Trans-palatal arch (TPA) was placed in order to preserve the perimeter of the upper dental arch. With an individual curve of the TPA the position of the upper left first premolar (24) is changed and space is created for alignment of the upper left canine (23) in the dental arch.



Figure 3: Achieving occlusal relationships, esthetics and root stability in the maxilla

The desired effect in the position of the first premolar is its' medio-palatal rotation to achieve a visual effect of a clinical crown resembling that of a canine (Fig. 2). The achieved result (Fig. 3) is optimal in this type of treatment. The correlation between upper and lower posterior teeth was class I, an optimal aesthetic effect was obtained when leveling the teeth in the upper dental arch, the periodontal status and gingival level of the upper left canines and premolars were preserved.

Clinical case 2

We present a clinical case of an 11-year-old patient with transposition of an upper left canine and premolar found by an incidental radiological x-ray during a regular orthodontic examination.

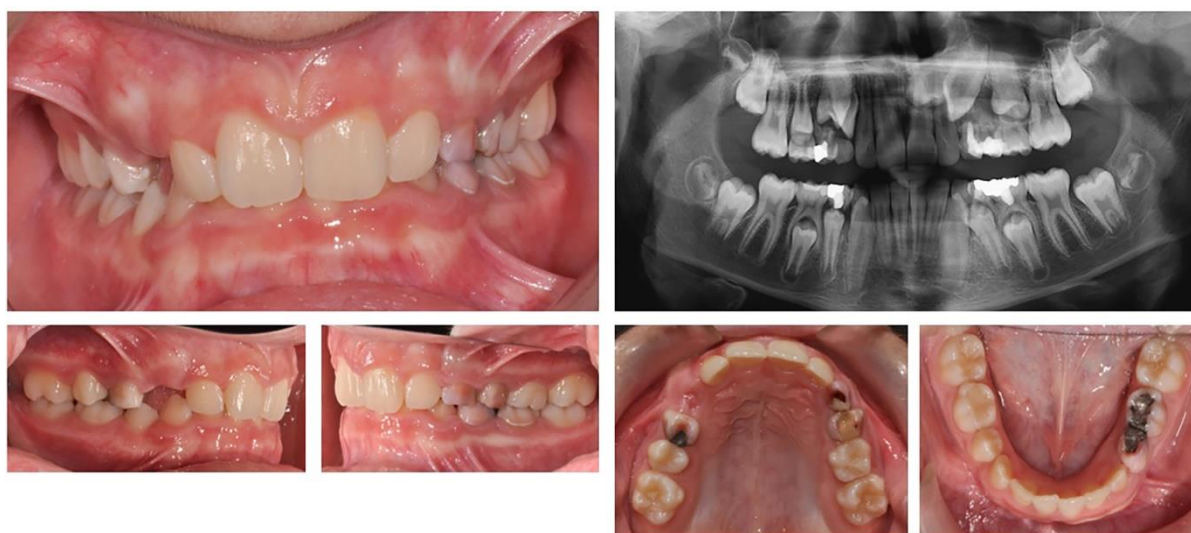


Figure 4: Intraoral image and radiographic finding of tooth transposition at primary orthodontic examination.

During the primary orthodontic examination of the patient, a deep occlusion was found and orthopantomography was done in connection with the evaluation of the

presence and formation of the dental permanent teeth and the resorption of the temporary teeth (Fig. 4). Orthopantomography revealed a transposition in the upper left segment between the first premolar and canine and probable transposition in the right segment. The patient was assigned a CBCT scan.

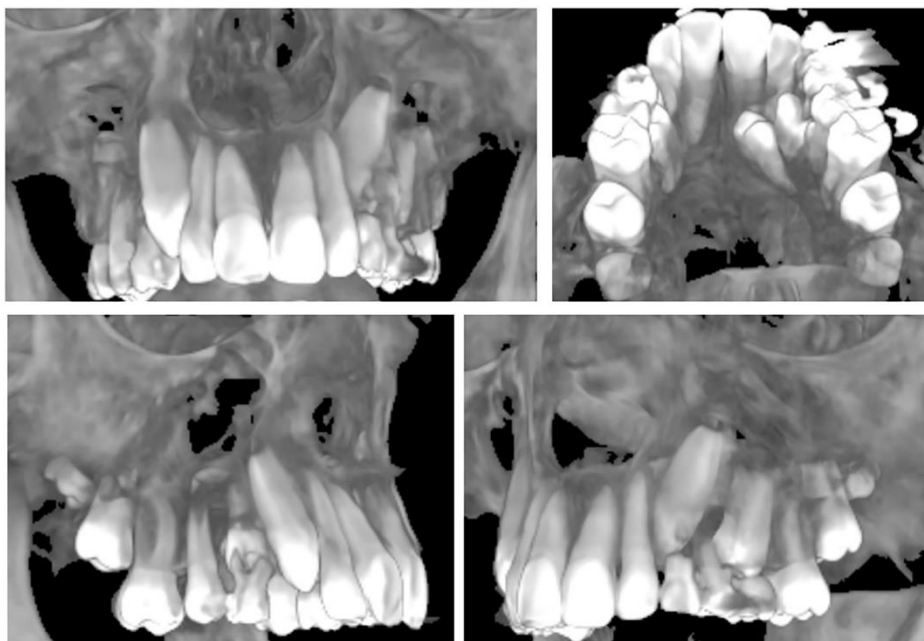


Figure 5: CBCT visualization of the position of the permanent canines and premolars in the upper jaw.

A transposition of the upper left canine (23) and first premolar (24) was demonstrated by the CBCT scan, with tooth 24 retained and palatally localized. This topography completely excludes the possibility of repositioning the teeth in the normal order and the alignment of tooth 24 in the dental arch. In the right segment, no transposition was found, but only a palatally displaced and significantly axially rotated first premolar (14).

Orthodontic treatment with extraction of the upper left first premolar and levelling of the upper dental arch with a logical sequence of teeth by tooth groups (canine to lateral and premolar) was planned and accepted by the parents.

Treatment stages include early extraction of all temporary upper posterior teeth and guiding the eruption of the permanent premolars and canines; preserving the perimeter of the upper dental arch and leveling the permanent teeth in the upper and lower dental arches, correcting the occlusal relationships.

A laser-sintered trans-palatal arch was fitted in order to preserve the position of the upper first molars and to include them as anchorage when leveling the premolars (Fig. 6).



Figure 6: Tracking the eruption and leveling of the permanent canines and premolars in the upper dental arch

Surgical removal of all temporary molars and canines and extraction of a palatally located upper left first premolar was performed. The eruption of the permanent teeth was monitored and their leveling in the upper dental arch was achieved with a fixed technique. The symmetry (incisal point) in the upper dental arch is preserved. The orthodontic treatment achieved therapeutic occlusion on the left and good esthetics of the smile.

RESULTS

Treatment goals were accomplished in both clinical cases. Positioning of the teeth in the upper dental arch was achieved in relation to the treatment plan and the individual features of the deformities. Occlusal disorders as deep bite is normalized. Functionality of the dentition was achieved with the maximum occlusal contacts in the left lateral segments where the disturbances (transposition) were in both patients. Satisfactory parallelism has been achieved at the root level of the leveled teeth from the transposition. The gingival levels of canines and premolars are preserved in complete integrity, without development of recessions. The position of the first

premolar on the left in clinical case 1 is pursuant, in order to resemble the clinical crown of a canine.

DISCUSSION

The goals of orthodontic treatment for canine and premolar transposition are to establish good static and functional occlusion, as well as facial aesthetics. All of these treatments must be tailored to temporomandibular joint function and periodontal health. In the treatment of dental transposition, many factors must be considered that can influence treatment results, such as patient age, dentofacial aesthetics, functional occlusal requirements, treatment duration, patient motivation and cooperation, periodontal support and type, as well as and severity of occlusal disorders. Age is the single most important factor above all other factors that is directly related to tissue regeneration [17]. The decision to extract one of the transposed teeth or complete correction of the transposed teeth to their normal positions depends on their topography and individual characteristics of the bone. Many authors believe that the ideal treatment approach is to completely adjust the transposed teeth to their normal position; however, this may not be possible in many clinical situations. This is the situation in the second discussed clinical case. Its position horizontally in the palatal bone does not allow its withdrawal and introduction into the arch, even in a reversed position. Extraction is a sensible move that reduces the risk of an iatrogenic effect. The risk to the teeth and adjacent tissues and the duration of treatment should be assessed and discussed with the patient prior to orthodontic treatment. Their informed consent to the course of treatment is important for the final decision. Resorption and recession are other important factors to consider among the major iatrogenic post-treatment effects that concern clinicians in transposition cases [18, 19]. The high risk of vestibular recession and loss of periodontal tissues from medial movement of the canine in the first clinical case was the reason to arrange the teeth as follows (24-23). In repositioning the first premolar and canine, it is necessary for the premolar to move distally in palatal solid bone and the canine to move vestibular in contact with the buccal compacta. Both moves are quite risky, which implies a preliminary assessment between the benefit and the risk. In the two presented clinical cases, optimal results were achieved in relation to the severity of the orthodontic problem - tooth transposition and the accompanying orthodontic occlusal deformity - deep bite. The establishment

of the phenomenon – transposition is the result of an accidental X-ray diagnosis during the primary examination of the patients, and in a fairly early phase of the formation of the permanent dentition.

CONCLUSION

Upper canine and first premolar transposition can be successfully treated with early diagnosis and orthodontic planning of tooth movements. It is important to respect the biological boundaries and limits of bone remodeling so as to prevent root resorption and periodontal damage. Treatment of transposition by the extraction of one of the transposed teeth (most often a premolar) is a good approach in order to achieve orthodontic goals, preserve the patient's periodontal health and achieve optimal smile aesthetics.

BIBLIOGRAPHY:

1. Shapira Y, Kuftinec MM. Tooth transpositions - a review of the literature and treatment considerations. *Angle Orthod.* 1989; 59:271–276.
2. Sabri R, Zaher A, Kassem H. Tooth transposition: a review and clinical considerations for treatment. *World J Orthod.* 2008Winter; 9(4):303-18.
3. Yordanova G., M. Dinkova, Study on rate and characteristics of dental transposition, *CR Acad. Bul. Scien.*, 2015; 68 (1):107-114.
4. Sella Tunis, T. Sarne, O. Hershkovitz, I.; Finkelstein, T. Pavlidi, A.M. Shapira, Y. Davidovitch, M. Shpack, N. Dental Anomalies' Characteristics. *Diagnostics* 2021, 11, 1161.
5. Loli D. Dental transpositions: a systematic review. *WebmedCentral Orthodontics* 2017;8(11):WMC005408
6. Ely NJ, Sherriff M, Cobourne MT. Dental transposition as a disorder of genetic origin. *Eur J Orthod.* 2006; 28: 145– 151.
7. Lorente C, Lorente P, Perez-Vela M, Esquinas C, Lorente T. Orthodontic management of a complete and an incomplete maxillary canine-first premolar transposition. *Angle Orthod.* 2020 May 1; 90(3):457-466.

8. Sahim S, SafiEddine Z, El Aouame A, El Quars F. Diagnosis and Orthodontic Management of Transposition: A Review. Open Access Library Journal. 2022; 9: e9374
9. Yordanova G, Grancharov M, Gurgurova M. Abnormality in the morphogenesis of the tooth development and their relationship with orthodontic deformities and treatments. Case Reports in Dentistry. 2021; p8
10. Shapira Y, M. Kuffinec. Maxillary tooth transpositions: Characteristic features and accompanying dental anomalies. Am Jour Orthod Dentof Orthop. 2001; 119: 127–134.
11. Mattos B, Carvalho J, Matusita M, Alves A. Tooth transposition – A literature review and a clinical case. Braz. J. Oral Sci. 2015; 5(16):953-7.
12. Peck S, Peck L. Classification of maxillary tooth transpositions. Am J Orthod Dentofacial Orthop. 1995; 107: 505-17.
13. Papadopoulos M, Chatzoudi M, Kaklamanos E. Prevalence of tooth transposition. A meta-analysis. Angle Orthod. 2010 Mar; 80(2):275-85.
14. Capelozza Filho L, Cardoso A, An T, Bertoz F. Maxillary canine-first premolar transposition. Angle Orthod 2007; 77:167–175.
15. Pi-Huei Liu, Eddie Hsiang-Hua Lai, Hsiang Yang, Jenny Zwei-Chieng Chang. Orthodontic treatment of a complete transposed impacted maxillary canine. Journal of Dental Sciences. 2015; 10(1): 102-108.
16. Mandla D. "Orthodontic Treatment of Bilateral Transposition of Maxillary Canines and Lateral Incisors", Case Reports in Dentistry, vol. 2022, Article ID 8094008
17. Ciarlantini R, Melsen B. Maxillary tooth transposition: correct or accept? Am Jour Orthod Dentof Orthop. 2007; 132(3):385–394.
18. Matsumoto M, Stuani M. Tooth transposition: a multidisciplinary approach. Dental Press J Orthod. 2018 Jan-Feb; 23(1):97-107.
19. Bocchieri A, Braga G. Correction of a bilateral maxillary canine-first premolar transposition in the late mixed dentition. Am J Orthod Dentofacial Orthop. 2002 Feb; 121(2):120-8.