



Dental transpositions: a systematic review

Peer review status:

No

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Article ID: WMC005408

Article Type: Review articles

Submitted on: 20-Nov-2017, 11:14:40 PM GMT **Published on:** 23-Nov-2017, 12:17:01 PM GMT

Article URL: http://www.webmedcentral.com/article_view/5408

Subject Categories: ORTHODONTICS

Keywords: dental transpositions, canine transposition, transposition treatment, transposition etiology, transposition prevalence

How to cite the article: Loli D. Dental transpositions: a systematic review. WebmedCentral ORTHODONTICS 2017;8(11):WMC005408

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Source(s) of Funding:

none

Competing Interests:

none

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Abstract

Tooth transposition is a form of ectopic eruption that requires an intensive exploration of treatment options prior to treatment. Treatment options include alignment of teeth in their transposed positions, extraction of one or both transposed teeth, or orthodontic movement to their proper positions in the arch. If a probable transposition is detected early enough, interceptive orthodontics may be used with little disturbance to the supporting structures. In cases of complete transposition, where the roots are parallel, an attempt to move the teeth to their correct position in the arch may be detrimental to the teeth or supporting structures. Longer treatment time and possible gingival recession are disadvantages to correcting transposition. The actual treatment of complete transpositions is always challenging, whether to correct or accept the transposition, the final result will depend on factors such as age, dental morphology, malocclusion, facial esthetics, stage of root development, position of root apices, and magnitude of the transposition.

Introduction

A tooth may deviate from its normal path of eruption usually because of severe crowding or presence of an obstacle such as a supernumerary tooth or an odontoma. Such eruption deviation can occur with no apparent local or systemic cause, resulting in ectopic eruption of the tooth in a place normally occupied by another permanent tooth.¹

The most frequently ectopically erupted tooth is the mandibular permanent lateral incisor which may occur unilaterally and bilaterally²⁻⁵. A study on the occurrence of ectopic erupting permanent teeth has shown that 30% involved the mandibular permanent lateral incisors unilaterally and bilaterally⁶.

The permanent lateral incisor when is in its pre eruptive migration and the deciduous lateral incisor root is resorbing, may for unknown reasons, deviate from its normal eruption path and become distally displaced, resulting in an overretention of the deciduous lateral incisor and erupting in a transposed position with the permanent canine⁷.

Tooth transposition is a relatively rare dental position

abnormality. This term is applied to extreme cases of ectopic eruptions. All transpositions are a form of ectopic eruptions, but not all ectopic eruptions qualify as transpositions. It can be defined as the positional interchange of two adjacent teeth, especially their roots, or the development or eruption of a tooth in a position occupied normally by a nonadjacent tooth.⁸

Methods

Aim of this study is to make a systematic review of transpositions. Pub Med and Scopus are used. Keywords were: transposition, canine transposition, transposition treatment, transposition etiology, transposition prevalence. 43 Articles are selected.⁸

Review

Transposition occurs much more commonly in the maxilla than the mandible. Unilateral transposition is more common than bilateral transposition and the left side is more involved.⁸⁻¹⁰ Among the many types of transpositions, maxillary canine-premolar transposition (MxC.P1) is clearly the most frequent type, so it has been the one most often reported.^{8,9-13}

Transposition occurs most frequently between the maxillary canine and first premolar and occasionally between the maxillary canine and lateral incisor^{9,14}. Rare cases of transposition between a canine and a second premolar or an incisor have been reported¹⁵. Only few cases of bilateral transposition of a canine and lateral incisor in the mandible have been reported^{1,16,17}.

It is called complete transposition if both the crown and the entire root structure of the involved teeth are found parallel in their transposed position. It is called an incomplete transposition if the transposition is of the crown, but not the root apex.^{8,9,11}

In literature cases in deciduous teeth are not described.

In the general population the prevalence of this abnormality varies according to sample, but remains under 1 per cent in most investigations.^{18,19,20}

Tooth transposition is a rare phenomenon (0.33%) with various sometimes inexplicable forms of manifestation. Its unilateral occurrence is considerably higher than the bilateral.²¹

The prevalence of tooth transposition¹ varies according to different studies and was found to be 0.43% of patients in India¹⁸, 0.38% in Turkish population¹³, and 0.14% of patients in Nigeria^{20, 22}, whereas the prevalence of mandibular canine-lateral incisor transposition is only 0.03%²³

Doruk²⁴ indicated an incidence of 0,08%-0,16%.

Thilander²⁵ suggested an incidence of 0,13 % in Population of Sud Arabia.

The etiology of transpositions is unknown and the reason why a tooth deviates from its normal path of eruption is still obscure. Many types of transpositions have been associated with factors that have a genetic basis^{12,26} including female predilection^{26, 27,11}, unilateral left-sided dominance^{27,11}, hypodontia^{27,11}, peg-shaped maxillary lateral incisor teeth^{27,11} and Down syndrome²⁸; interchange in the position of the developing tooth buds^{26,27} altered eruption paths²⁹, prolonged retention of deciduous teeth³⁰, trauma and mechanical interference to the erupting permanent teeth.^{15,26,30}

Tooth transposition has been reported to be associated with other dental anomalies such as missing teeth, small or peg-shaped maxillary lateral incisors, retained deciduous mandibular lateral incisors and canines, rotations and malposition of adjacent teeth, and root dilacerations and impactions¹¹.

The early mixed dentition period, between 6 and 8 years, is the best time for assessing the development and path of eruption of the mandibular permanent lateral incisors. These children are usually first examined by a pediatric or general dentist who should evaluate both the dental health condition and the dental development. The use of a panoramic radiograph is very useful for early diagnosis of the position and the path of eruption of the unerupted teeth.¹

Babacan⁸ suggested in order to make diagnosis to perform panoramic radiograph and computed tomography (CT) which is used to obtain more detailed information about the transposition and the near structures to teeth transposed.

Ciarlantini and Melsen³¹ listed the following factors to be considered for treatment planning: Age, dental morphology; occlusal considerations; facial esthetics; stage of development and position of the root apices, and magnitude of the transposition.

Treatment considerations for transposed teeth include repositioning them in their normal place in the dental arch, aligning them in their transposed position with crown reshaping, or extracting one of the transposed teeth with orthodontic treatment of alignment but only

if in the arch there are other factors that suggest extractions such as destructive caries, crowding therapy and facial profile.¹

Shapira et al¹ suggested in managing treatment for mandibular transposition canine-lateral incisor, that several factors should be considered such as the amount of distally displaced lateral incisor and the intrabony position of the permanent canine. Early detection of the abnormal eruption path of the lateral incisor allows for early intervention by uprighting and moving the lateral incisor to its normal place in the arch prior to the eruption of the canine into transposition with the lateral incisor. This was successfully achieved in the presented case only on the left side. On contralateral side, however, the position of the canine was already between the central and lateral incisors and to avoid a possible risk of root resorption it was allowed to erupt into complete transposition with the lateral incisor. The canine's cusp tip was reshaped to resemble a lateral incisor.

Babacan et al⁸, because of the patient's willingness and the space of the persisting deciduous in the arch provides the space necessary for non extractive orthodontic alignment procedures, orthodontic management of transposition were decided. Age is the noticeable factor beyond the factors listed above, which is directly correlated with the tissue regeneration. They suggest as a general rule that it is not advisable to correct a transposed tooth order because of insufficient buccopalatal width of bone support when two adjacent teeth are moving in different directions, especially after eruption^{10,27}. Many recent reports³²⁻³⁷ showed recession at the gingival margins of the repositioned canines because of the long way of the canine through the buccal dense compact bone. The other problem in restoring the natural tooth order was the prolonged treatment due to difficulties in root movement and because of the potential risk of forcing the premolar root against the canine root. They indicated that attempting to correct transposed teeth in the permanent dentition is not advised because of the potential risk of damaging the teeth or supporting structures. Therefore, alignment of the involved teeth in their transposed position seems to be the best alternative.⁸

Sandam and Harvie³⁸ indicated that when the transposition is in posteruptive phase it is recommended to accept this position abnormality.

Weeks and Power³⁹ underlined the disadvantages to orthodontically correct transposed teeth.

Peck²⁶ suggested to orthodontically correct only pseudo-transpositions and not true transpositions for

their difficulty.

Acceptance of the transposition is the predominating treatment strategy described case reports in the literature, but some Authors, analyzing many factors prior to initiate the treatment, have reported transpositions treated with fixed appliance .

The consideration is based on that whatever the treatment plan is, correcting a complete transposition is difficult, time consuming³¹ and has a higher chance for negative side effects on the periodontium⁴⁰, while accepting the transposition will commit the patient to extensive restorative work.⁴¹

Authors⁴² have presented a case in which consider if accepting the unilateral transposition with the agenesis of the laterals meant that the patient will have two alternatives, either space opening for an implant or space closure with extensive restorative work to the premolar. If an implant is planned, the patient will have to wait until the end of the growth to get the final restoration meanwhile a temporary alternative is inevitable (Maryland bridge, etc.). If space closure is considered, crowning of the premolar is inevitable and an endodontic treatment is fundamental and this alternative will lead to a final asymmetrical situation. Thus, correcting the transposition and taking the risks of recessions was acceptable especially when the patient had a low lip line and a high position of the canine (apical relative to the premolar). So, if a slight recession occurs on canine it would not affect the final esthetical outcome of the treatment.

Â In the other second case presented, the young age of the patient, the high position of the canine and the low lip line favored the correction of the transposition. Although this option committed the patient to a longer treatment duration, it would ensure a symmetrical outcome with no need for restorative procedures.

Other Authors⁴³ described the treatment of an ectopic maxillary left canine and Class II molar relationship in a 12 years old girl.Â A pendulum appliance was used in a first phase of treatment to distalize the maxillary molars to a Class I molar relationship. In the second phase of treatment, a mini-implant, inserted between the roots of the left maxillary central and lateral incisors, provided anchorage to move an ectopic maxillary left canine into position.Â The implant remained stable throughout treatment and a maxillary canine - first premolar transposition was corrected. Good overjet and overbite were achieved and have been maintained one year after completion of active treatment.

Conclusions

Early detection of a transposition at the early mixed dentition, at the age of 6â€“8 years, and timely interceptive intervention may reduce the risk of tooth transposition and avoid complex orthodontic therapy. When treating transpositions, especially MxC.P1, many factors that affect the treatment results must be considered, such as esthetics, occlusion, treatment period, patient comfort, patient cooperation, and periodontal support. Acceptance of the transposition is the predominating treatment strategy in case reports in the literature. Even though diagnosing and planning the treatment of a transposition has been made easier nowadays with the advent of the cone beam computed tomography (CBCT), the actual treatment of complete transpositions is always challenging, whether to correct or accept the transposition, the final result will depend on several factors. A correct treatment plan and well-designed treatment mechanics along with good finishing are a must to ensure a good final result.

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