

A Dental Transposition: Literature Review and Clinical Management

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Abstract: Tooth transposition is a rare developmental anomaly characterized by positional interchange of two teeth within the same quadrant. Its incidence compromises the esthetics and function to a significant degree. The current literature review is offered to highlight certain aspects of this anomaly to develop an understanding that might be helpful in management for restoration of esthetics and function of affected patients. The dental transposition of the teeth were classified into 2 types that are complete transposition and incomplete. A complete dental transposition describes a condition in which the dental crown and all structure of the dental root have a parallel position to the exchanged positions. This paper aims to report the successful treatment of a canine complete transposition case with upper lateral incisor done at a patient. This dental transposition procedure requires a long time treatment, because this is done slowly and carefully. The treatment of transposition case between canines with upper lateral incisor that are done to the patient is successful enough.

Key words: Dental transposition, canine, lateral incisor, fixed appliance

I. Introduction

Tooth transposition is defined as a type of eruption anomaly where there is either an exchange of position between two adjacent teeth, or the development and eruption of a tooth in a position normally occupied by another non-adjacent tooth [1]. Transposition was first described by Harris [1] in 1849, as an aberration in the position of teeth. [2]

Transposition may affect both sexes equally and, although it may occur in the maxilla or in the mandible, the frequency of maxillary permanent canine involvement is the greatest. [3] In the maxilla the canine is transposed most frequently with the first premolar, less often with the lateral incisor followed rarely by central incisor or second premolar. In the mandible transposition is reported to involve the canine and lateral incisor only [3,4].

It has been reported that transposition of maxillary teeth occurs approximately in one of 300 hundred orthodontic patients and that transposition between the canine and first premolar appears most often (70%) in maxillary dentition, followed by one between canine and lateral incisor (20%). [2,3]

Transposition has never been reported in both arches simultaneously and it has never been reported to occur in the deciduous dentition. Unilateral transpositions are found more often than bilateral transpositions and show left side dominance. [2, 5]

Prevalence varies according to different authors. Thus, it was found 0.38% in Turkey, 0.13% in Saudi Arabia, 0.43% in India. Prevalence in syndromic patients is significantly higher. Tooth transpositions are observed at a rate of 14.29% in patients with Down's syndrome and at a rate of 4.1% in cleft palate patients. [6]

According to most researchers, transposition is more frequent in women, in the maxilla, as a unilateral condition and in the left facial half. [7]

The etiology of transposition is still unclear. A possible explanation for tooth transposition would be an exchange in position between developing tooth buds and also genetic or hereditary factor can play a role. [8-14] etiological factors include the following:

- Exchange of tooth germs during odontogenesis or maybe even exchange of cells of dental buds at the dental lamina in earlier stages

- Pathological osseous condition, such as tumor or cyst

- Heredity. The order of tooth positioning in the arch is determined in the DNA by genes related to dental development. Consequently, genetic regions causing transposition must exist as a result of aberrant gene function at this region. Furthermore, factors contributing to the genetic etiology are the different frequency of

transposition occurrence among races , the high frequency of related dental anomalies, such as peg-shaped lateral incisors and congenitally missing teeth , its frequent bilateral occurrence , involvement of the same teeth in both halves in bilateral cases , as well as numerous cases within the same family tree .

-Trauma during early childhood (1.5-6 years) . Transpositions coexisting with root ankylosis and rotations of neighboring teeth suggest factors of traumatic etiology .

-Synchronization between tooth and jaw development, especially of the mandible.

-Crowding due to mesial movement of posterior teeth. However, it should be noticed that in most transposition cases there is enough space available for normal tooth alignment.

-Early loss of primary teeth, or even of permanent teeth . In the case of delayed resorption of the primary predecessor, the dental crypt of its permanent

successor does not take its proper position, whereas early loss of the first maxillary permanent molar, for some reason, triggers distal canine displacement . However, prolonged presence of primary teeth is considered the result rather than the cause of transposition .

- Migration of the ectopic tooth, usually the canine, during the eruption process. The permanent canine starts developing at the age of 4-5 months, its crown is completed at 6-7 years of age, it erupts at the age of 11-12 years and its root formation is complete by the age of 13-15 years. In the maxilla, at 4.5 years of age, the permanent canine lies above the first premolar, which in turn, is above the primary first molar . The eruption path is often guided by root orientation, but it may change as

the erupting tooth approaches another tooth. Space conditions in the jaws, mechanical obstacles and varying rates of development may affect and modify

the direction of the erupting tooth. Slow eruption, in combination with the anatomical position of the canine crypt within the jaw, may contribute to the development of canine transposition.[8-14]

Among the maxillary teeth permanent canine is the most frequently involved tooth in transposition usually with the first premolar, and less often with lateral incisor. - The transposition of maxillary permanent canine with central incisor, second premolar, and even first molar have been reported. Extremely rare cases of tooth transpositions without the involvement of canine are also reported, i.e., maxillary central and lateral incisors transposition.[3,15]

A complete transposition is one in which both the crown and the entire root of the involved teeth exchange places in the arch and are fully parallel. In incomplete transposition (also called "pseudo" or "partial-transposition") the crowns may be transposed while the root apices remain in the normal position. Alternatively, the crowns may be in correct order while the root apices are transposed, thus the two involved teeth overlap and their long axes cross each other.[16]

Unilateral tooth transpositions have been reported far more frequently than bilateral and left side becomes the victim more frequently than the right side Only one case of asymmetric transposition in both arches was found in the literature, involving maxillary canine and the first premolar on the right side and of the mandibular canine and the lateral incisor on the left side .[17]

Peck S. and Peck L.[1,11,12] classified maxillary tooth transposition in a classic article published in May 1995 in American journal of orthodontics and dentofacial orthopedics. On the basis of anatomic factors, five types of maxillary tooth transpositions were firmly identified among 201 people in their study. The classification is stated below according to the teeth involved .

1. Canine-First premolar [**Mx. C. P1**]
2. Canine-Lateral incisor [**Mx. C. 12**]
3. Canine to First molar site [**Mx. C to M1**]
4. Lateral incisor-Central incisor [**Mx. 12. I1**]
5. Canine to Central incisor site [**Mx. C to I1**]

Tooth transposition is often accompanied by several congenital dental disturbances such as peg-shaped lateral incisors, hypodontia, ankylosed milk teeth, severely rotated teeth, and dilacerated teeth. Shapira et al reported 18.5% of the individuals with transposition to have one or more missing teeth, excluding third molars. Lateral incisor was the most frequently missing tooth (14%). This was followed by the maxillary (6%) and the mandibular (3%) second premolar. Small sized lateral incisors were detected in 9% of the cases with transpositions. 32% individuals had retained milk teeth, 45% had severely rotated maxillary canines and 14% had impacted third molars.[1,18]

Canines are the most often dental in experiencing transposition. The dental of upper canine is probably dental who is the most varied position in the composition of human teeth and important for the orthodontist who often must find their location and move it. These teeth are often out of dental arch to the facial and palatal. It appears that from the canine transposition of first upper premolar sometimes show

on the transposition of canine eruption in the side of facial between the first and second premolars, especially if there is still deciduous canine, so that it affects deficiency of arch length. Canine often rotates to the mesial, while the first premolar rotates to the distal and sometimes rotates to mesiopalatal.[1,19]

This article reviews transpositions with their treatment possibilities under consideration of esthetic, functional, and biomechanic aspects. With a clinical case presentation the treatment approach to dissolve a transposition of a upper canine and a lateral incisor is demonstrated and discussed.

II. Clinical Management

Treatment options include alignment of the trans-posed teeth in their transposed state, extraction of one of them or complete correction of the transposition. The ideal approach will be to completely correct the transposition of the teeth but most of the times it may not be possible, although in the recent literature several case reports have shown success with this approach. Several factors must be considered when transpositions are being corrected such as positions of root apices, facial esthetics, malocclusion, age of the patient, motivation and expectations of the patient. Risk to the teeth and adjacent tissues and treatment time must be discussed with the patient prior to correction. Alignment in the transposed position will involve reshaping the crown morphology and periodontal gingival recontouring procedure.[20]

Early diagnosis of a developing transposition is extremely important and has a great influence on prognosis. This may usually be performed by a radiographic examination when the patient is between 6 and 8 years of age. When the alteration is detected early, interceptive procedures including extraction of deciduous teeth and placement of eruption guides for the permanent teeth may be performed, thus preventing complete development of the anomaly. On the other hand, when transposition is detected at a later stage, orthodontic treatment planning and intervention must be addressed. Upper canine-premolar transposition in adult patients allows consideration of several treatment options, with or without extraction of the premolar.[21,22,23]

Treatment with premolar extraction is considered as one of the alternatives. The transposed tooth is then moved to its natural position. This treatment approach is preferred when there is a severe arch length deficiency. Root interference needs to be considered. Root interference during tooth movement to correct tooth order tends to occur more frequently in canine-premolar transposition than in lateral-canine transposition. This probably occurs because the labiolingual width of a premolar is much wider than that of the lateral incisor.[22,23]

III. Case Report

This is a 14-year old girl presented with transposition of upper left canine and lateral incisor, with minor dental anomaly as appearing by a panoramic radiograph and intraoral photos, she has a skeletal and dental Class I relationship.

From occlusal intraoral view, upper arch was asymmetric due to upper left canine lateral incisor transposition. The upper and lower arches had no problem with crowding.(Fig.1a,b,c)
The radiographic findings by a panoramic x-ray revealed a complete transposition of the upper left canine and lateral incisor. (Fig.2a,b)

Treatment options were either to accept the transposition or to correct it, we chose to correct the transposition and to place the canine to its physiologic position in order to restore good esthetics and normal masticatory function.

Treatment started first by placing the brackets on the anterior teeth and a bands around the upper first molars (2x4 bonding) and constructing a transpalatal arch for the anchorage of the posterior teeth. (Fig.3)

A coil spring was used on a stainless steel wire to push the lateral incisor to physiologic position while opening a space for the transposed canine.(Fig.4)

The lateral Incisor was moved further palatally in order to clear the way for the movement of transposed canine, and to prevent bony loss at the cortical plate of the labially positioned canine and to avoid root proximity between the canine and the lateral incisor thus avoiding root resorption and periodontal compromise. .

After achieving contact between the central and lateral incisor, space was enough for correct the position of the canine. For the movement of the canine to its physiologic position a segment arch with construction loop was used. For the final alignment of the canine in the dental arch it was bonded with bracket. During the treatment of 24 months, the teeth 22 and 23 which experienced transposition have corrected in a good position. Teeth 21 which rotated have also corrected. The roots of the teeth 22 and 23 appear on the panoramic x ray in a good position. (Fig.5)

In this case, we do not move tooth that is in transposition toward palatal but only pulling the canine toward distal, move lateral incisor to mesial, slowly and with light force. At the time of tooth 22 has occupied its proper position, coincide with tooth 21, so it seems that gingival of tooth 21 covers onethird of the tooth crown.

Active treatment continued over 20 months, at the end of treatment canine and lateral incisor transposition was corrected, Class I molar and canine relationship was achieved with average overbite and overjet, retention was by using a fixed retainer and a Hawley retainer in the upper arch(Fig.6a,b) . The treatment of transposition case between canines with upper lateral incisor that are done to the patient is successful enough. The root and crown are in good position, and class I interdigitation(Fig.7). The enlargement therapy for the lateral incisor is gingival resection by a more competent experts in periodontology.

IV. Discussion:

The maxillary canine is one of the most commonly transposed teeth) but its transposition generally occurs in combination with other anomalies such as agenesis (40%), deciduous canine retention (50%), and peg-shape maxillary lateral incisors (25%)). The left side is often more involved than the right side (69%) .The rate of bilateral transposition has been reported as 5%.

Although the causes most frequently cited for transposition are primary canine retention or early loss. The transposition of analog teeth in the process of odontogenesis, deviation of the path of eruption, and heredity, no definitive conclusion has been reached.

In this case, including the types of the canine-lateral incisor (Mx.C.I2) transposition and occurs in the left region which the case is often occur than the other tooth transposition.

If the lateral incisor and canine has erupted in the position of transposition, it is usually not made an effort to correct the teeth into its normal position.[3]

The dental alignment are in a position of transposition and incisor reshape the surface of so that it will not damage the tooth or its supporting network and will

obtain an aesthetic result that can be accepted. The dental rotation and alignment are corrected of transposition position of the position, and then used the retainer anterior mandibular fixed by debonding because the cut of supracrestal gingival fibers on the

teeth that experience rotation.[15]

The treatment of this case of complete transposition was corrected by restoring the position of the teeth 23 and 22 to the right position with the consideration of aesthetics and function, the position of the root, and the availability of sufficient space to perform the extraction of tooth 63. The teeth 23 has not eruption yet so we can guide the eruption of 23 to the right position. Anterior teeth have an important function for arranging the continuing of dental arch, esthetic, and maintenance the form and function of the teeth Canine is part of anterior teeth that give important support for esthetic and function, so it is very important to maintenance the teeth and guide the eruption in the right position.[24]

In the presence of an impacted tooth, a frequent complication of traction is the possibility of the tooth not moving due to ankylosis. Moving an impacted tooth involves risks of devitalization, discoloration, external root resorption, injury to adjacent teeth, alveolar bone loss, gingival recession, increase in clinical

crown length and tooth sensitivity, which can lead to esthetic problems or tooth loss. In the reported case, alveolar bone resorption existed prior to treatment.

Gingival recession and increased clinical crown were also observed.[25]

The technique as well as the orthodontic appliances used in the traction of impacted teeth or in transposition correction will depend on a correct diagnosis and treatment plan. When adjacent teeth require individualized and controlled movements, fixed appliances are indicated . The mechanics of choice must be carefully planned. [19,24] . In this case the transposition was complete, and hence we decided to align the teeth orthodontically in the transposed positions and then reshape them for the purpose of esthetics. The patient and her parents were extremely satisfied with the results.

V. Conclusion

Tooth transposition manifests in various forms and may represent a condition of multifactorial etiology. Early diagnosis and detection by clinicians of a developing transposition is very important to prevent subsequent malocclusion and its attendant consequences.

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FIG.



Figure 1a-c: intraoral photos of a patient with complete canine lateral incisor transposition



Figure 2a, b: Complete transposition of the canine lateral incisor, the erupting maxillary left permanent canine was observed between the roots of the central and lateral incisors



Figure 3: Clinical situation after the glue for the place procurement



Figure 4: A coil spring was used to push the lateral incisor mesially and a segment arch with construction loop was used to move the canine distally



Figure 5: clinical situation during the treatment; incomplete canine lateral incisor transposition



Figure 6a, b: clinical situation at the End of the treatment; correction of the transposition



Figure 7: Panoramic radiograph showing the correct position of the canine and lateral incisor at the end of the treatment.