

Prevalence of Tooth Transposition in Arab Israelian(Arab48) Population;A retrospective study

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Abstract: Tooth transposition is a relatively rare developmental anomaly of the teeth characterized by a positional interchange of a permanent tooth leading to distortion in the alignment of the affected segment, a midline shift, and malocclusion of the teeth. In the general population, the prevalence of this anomaly has been reported to be below 1% in most investigations.

Aim: To investigate the prevalence of tooth transposition in a sample of Arab Israel(Arab48) dental patients.

Study Design: Epidemiological study.

Time And Place Of Action: , Time period 2006-2015,Arab Israel population

Materials And Methods; The records of 2200(1354 female,846 male) patients attending orthodontics therapy in the Center For Dentistry, research & Aesthetics ,Jatt,Israel. The age of the patients ranged from 10.2 to 39.5years, with a mean of 16,2years.

Main Measurements: Tooth transposition was investigated my means of clinical examination through observation and palpation, as well as with radiographic examination using panoramic radiographs. Results were analyzed with descriptive statistics.

Results: The prevalence of tooth transposition was found to be 0.55% in Arab Israelian population. Maxillary canine-lateral incisor transposition was found to have a higher frequency than maxillary canine-first premolar transposition. A higher prevalence in female than male by 33,34% was noticed.

Keywords: dental transposition, position anomaly, frequency,Arab Israel

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 Harris1 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]

etiologial factors include the following:

- Exchange of tooth germs during odontogenesis or maybe even exchange of cells of dental budsat 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]

N=2200	total	%
Transposition	12	0.55%
Non Transposition	2188	99.45%
Total	2200	100%

Table 1. Initial patient sample

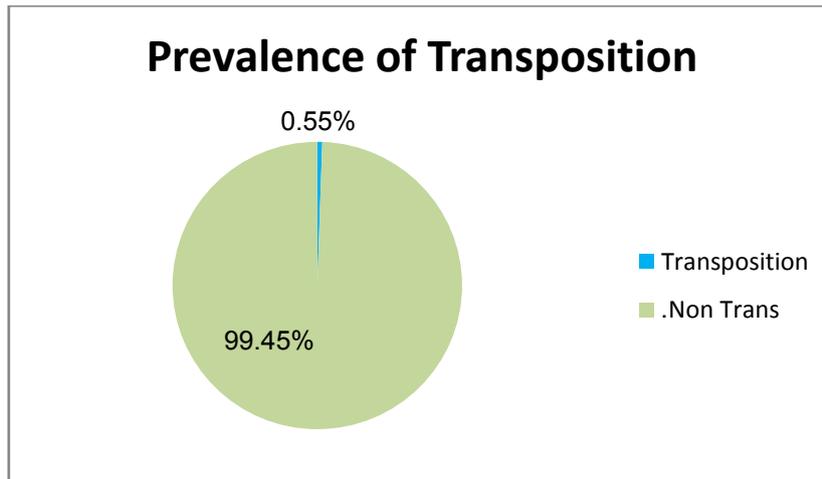


Fig.1; Initial patient sample

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. I2]
3. Canine to First molar site [Mx. C to M1]
4. Lateral incisor-Central incisor [Mx. I2. 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]

N=2200	total	%
Male	4	33.33%
Female	8	66.67%
Total	12	100%

Table 2;Sex distribution of the transposition

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]

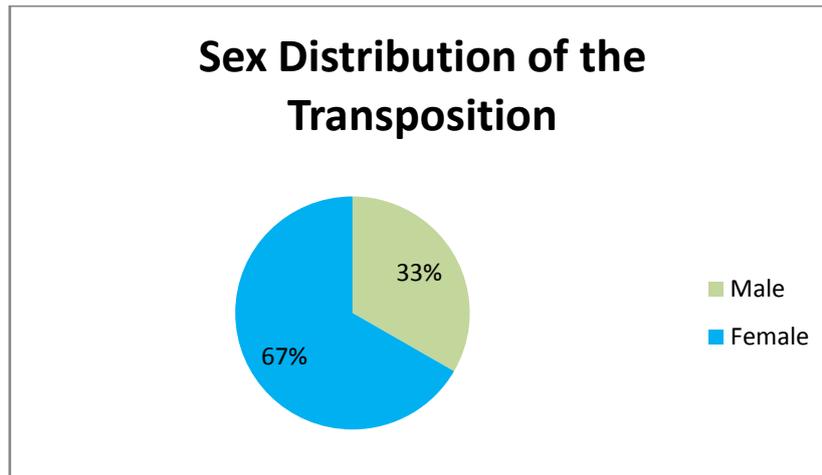


Fig.2;Sex distribution of the transposition

The aim of this study was mainly to investigate the prevalence of tooth transposition in the arab population in Israel(Arab48), and more specifically, in a sample of dental patients with permanent dentitions, and secondary to discuss the etiology and present the possible related concomitant pathological entities as found in the currently existing literature.

II. Materials and Methods

The records of 2200 patients(1354 female,846 male) attending the Center For Dentistry, research & Aesthetics ,Jatt,Israel , between Jan 2006 to Dec 2015 were examined by intraoral examination, palpation, and patient records, followed by panoramic radiographs for the study. Ethical clearance was obtained from the Institutional Ethical Committee. A written informed consent was obtained from all the patients. The age of the patients ranged from 10.2 to 39.5years, with a mean of 16,2years.

A special characteristic of the studied batch is that all subjects presented different forms of dentomaxillary anomaly.

Records were selected for study if the following criteria were met:

1. The children were ethnic Palestinian(Arab48);
2. No systemic syndromes were present;
3. True/complete transposition of one or more teeth had been diagnosed in the maxillary arch; To qualify as true/complete transposition, both the crown and the entire root structure of the involved tooth had to have been transposed
4. Good-quality panoramic radiographs taken at the time of diagnosis had to be available. All panoramic radiographs were taken with CP-G Plus films (Agfa; Mortsel, Belgium) in an Orthopantomograph OP100 machine (Instrumentarium; Tuusula, Finland). The films were processed in an automatic processor (Dent-X Excel; NY, USA) using Dürr-Automat XR solutions (Dürr Dental; Bietigheim-Bissingen, Germany). All selected radiographs and records were reviewed by the same author one month after the original analysis, and the findings of the two examinations were compared for discrepancies. Data were pooled and analyzed for sex and side distribution. The prevalence of associated dental anomalies was compared with that found in the general Arab Israel population (Arab48). Trends of differences were analyzed statistically using tests for categorical data (Fisher exact or chi-squared test) and were considered statistically significant at $P < 0.05$.

N=12	total	%
Max.	10	83.33%
Mand.	2	16.67%
Total	12	100%

Table 3;Maxillary distribution of the transposition

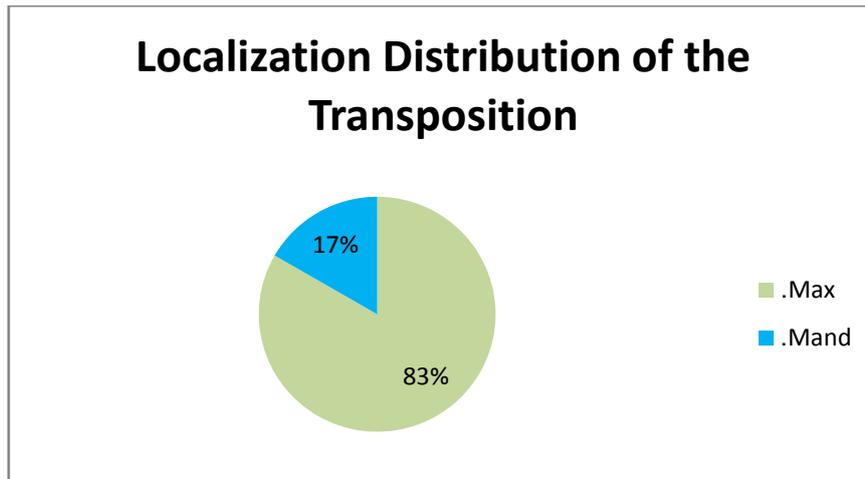


Fig.3; ;Maxillary distribution of the transposition

III. Results

Out of the total number of 2200 patients, 12 presented (4 male, 8 female) with different forms of dental transposition, representing a percentage of 0.55% (Table 1, Fig.1). Regarding the sex distribution, a higher frequency in females than males by a significant difference of 33.34% was noticed. (Table 2., Fig.2) The anomaly is found to be more frequent in the upper jaw (83.33%), but may exist at the mandible too 16.67%. (Table 3, Fig.3) A superior canine-premolar transposition was found in 58.33% of the cases, followed by 25% with a superior canine-lateral incisor transposition and 16.67% with an inferior canine-lateral incisor transposition. (Table 4, Fig.4)

IV. Discussion

According to the results of this study, the prevalence of tooth transposition in the Arab Israel (Arab48) population was found 0.55%. This agrees with the 0.14% rate observed in a sample of 8120 Nigerian dental patients of unknown age [20].

A similar rate of 0.13% was observed in a sample of 1581 Saudi Arabian dental patients of unknown [21]

However, other studies show higher rates of tooth transposition. In a sample of 5496 Turkish dental patients, the prevalence of transposition was found to

be 0.38% [5] and in a sample of 4933 Indian dental patients aged 15-60 years was 0.43% [13] It seems that prevalence of transposition differs significantly according to race and region of sample selection. Nevertheless, the results of this study are closer to those of Nigerian and Saudi Arabian studies.

Statistically, the maxillary permanent canine is the most frequently involved tooth in transposition (0.135-0.51%) and shows the highest incidence of transposition with the first premolar. Although less frequent, but canine transposition has also been documented with lateral incisor, central incisor and rarely with the second premolar or first molar. [22]

N=12		%
Mand.	2	16.67%
Max. Can./Lat.	3	25.00%
Max. Can./PM.	7	58.33%
Total	12	100%

Table 4; Topographic distribution of the transposition cases

Transposition of teeth is reported to be seen in permanent dentition only and is equally distributed between both males and females in terms of occurrence. Certain investigators however found out that females are more affected than males. [23] So far no case has been documented where tooth transposition occurred simultaneously in both jaws. Also tooth transposition has not been reported to occur in primary dentition. [24]

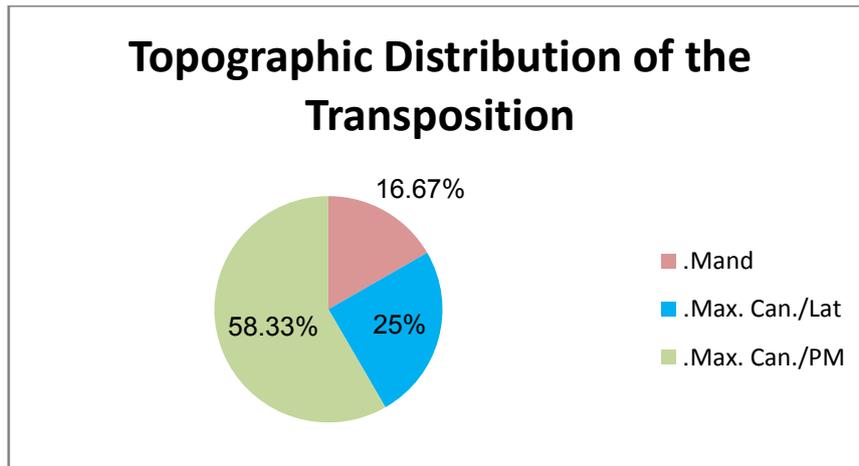


Fig.4; Topographic distribution of the transposition cases

Bilateral transposition was found to be less common than unilateral transposition in both arches [11,15] In all of the bilateral cases, the same teeth were affected on each side; asymmetrical bilateral transposition is extremely rare.[25]

Tooth transposition seems to be more frequent in women than in men with a male to female ratio that differs according to sources, ranging between 27:48 [26], 20:34 [17]) and 25:40 [15]. This fact is partly confirmed by this study too, where the male to female ratio was 0:1. On the contrary, studies among Turkish dental patients showed equal prevalence rates for both genders with an 11:10 male to female ratio [5].

The prevalence of tooth transposition was found to be 0.38% in a Turkish population. Maxillary canine-lateral incisor transposition was found to have a higher frequency than maxillary canine-first premolar transposition. Mx.C.P2 transposition that had not been previously reported in the literature was observed in one of our cases. Transpositions had similar frequencies in both sexes.

The localization of transpositions differs according to its type. Although several dental anomalies were found at a high frequency in some types of transpositions, a direct correlation cannot be suggested.[5]

In a Greek study using an orthodontic sample of unidentified number and racial composition of patients aged 12-16 years, 16 transposition cases were found (9 in boys and 7 in girls). [27][Papadopoulos and etl. revealed that tooth transposition has a mean prevalence of 0.33%. This prevalence seems to be the same between the two genders. However, tooth transposition appears more frequently in the maxilla than in the mandible and more unilaterally than bilaterally.[28]

The aetiology of transposition has been an area of controversy. Various theories, such as canine migration (due to obstruction) or dental anlage exchange have been proposed.5,6 However, a genetic aetiology has been strongly supported by Peck et al[1]. Trauma to the deciduous teeth has also been suggested as a factor in the aetiology of transposition.[29] In our cases, a history of trauma was more frequent in

maxillary canine to central incisor site transpositions (50%). This result indicated that trauma was the main aetiological factor for maxillary canine to central incisor

site transposition as reported by previous studies. The percentage found in our study seems to be quite small, within the limits reported in other studies. At present, in western countries a variation between 0.5% and 2.5% is reported. The most affected was the superior canine (90%). This involves its neighbors in the transposition, most frequently the superior premolar in 70% of the cases, then the upper lateral incisor (20%).[30]

Tooth transposition is a rather rare phenomenon with various forms of manifestation and may be due to various etiological factors ranging from genetic determination to the given biomechanical conditions. Tooth transposition may occur alone or in combination with other pathological entities manifesting mainly in the oral cavity.

V. Conclusions

The prevalence of tooth transposition was found to be 0.55% in Arab Israelian population. Maxillary canine-lateral incisor transposition was found to have a higher frequency than maxillary canine-first premolar transposition. Mx.C.P2 transposition that had not been previously reported in the literature was observed in one of our cases. Transpositions had similar frequencies in both sexes. The localization of transpositions differs according to its type. A higher prevalence in female than male by 33,34% was noticed; this could be explained by a higher interest in the way they look like. The dental transposition affects the canine and its neighbors, the upper one more often than the lower one.

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