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Transmigration of Impacted Canines: A Report of Two Cases and a Review of the Literature.

Nezar Watted^{1*}, Emad Hussein², Obaida Awadi³, and Muhamad Abu-Hussein².

¹Department of Orthodontics, Arab American University, Palestine.

²Department of Pediatric Dentistry, University of Athens, Greece.

³Center for Dentistry, Research and Aesthetics, Jatt.

Case Report

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*For Correspondence

Department of Orthodontics,
Arab American University,
Palestine.

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ABSTRACT

The mandibular canine shows an unusual tendency to migrate to the opposite side of the jaw. Numerous theories have been proposed to explain this rare phenomenon and a broad classification has also been proposed. This paper reports a series of 2 cases with mandibular canine transmigration with special emphasis on etiology and classification of transmigrations.

INTRODUCTION

Transmigration is a rare phenomenon that typically affects the mandibular canines. There is no known etiology for its occurrence, however, there are many and varied etiological factors involved in transmigrated teeth, such as ectopic growth of the tooth bud, retention or premature loss of a primary tooth, inadequate eruption space and excessive length of crown. Genetic factors, endocrine disorders and trauma have also been also proposed as etiological factors [1,2].

Transposition was first described by Harris in 1849, as an aberration in the position of teeth. Characteristically, tooth transposition is defined as the positional interchange of two adjacent teeth, especially their roots, or the eruption of a tooth in a position occupied normally by a nonadjacent tooth.² It is considered to be an uncommon developmental dental anomaly of unknown origin in which the involved tooth develops and erupts in an interchanged position within the same quadrant [1,3].

Canine impaction is more prevalent in the maxilla than in the mandible, canine transmigration is more frequent in the mandible. In general population, the incidence of mandibular canine impaction ranges from 0.35% to 0.44% [4]. An even less common finding is the migration of a mandibular canine from its normal position to the contralateral side of the arch, crossing the midline. This phenomenon is known as transmigration, and it occurs almost exclusively with mandibular canines [5].

Tarsitano et al. defined transmigration as a phenomenon in which an unerupted mandibular canine migrates, crossing the mandibular midline [6]. Javid modified Tarsitano's definition, adding that at least onehalf or more of the length of the tooth is required to cross the midline. Auluck et al. suggested that the actual distance of canine migration across the mandibular midline is less important than the tendency of the canine to cross the midline [7]. Joshi considered the tendency of a canine to cross the barrier of the mandibular midline suture is a more important parameter than the distance of migration after crossing the midline [8].

The etiology of transmigration is unknown; however, abnormal displacement of the tooth bud or deviation during development is the most commonly accepted explanation [4]. Studies have suggest that proclination of the lower incisors, increased axial inclination of the unerupted canine and an enlarged symphyseal cross-sectional of the chin could play an important role in the mechanism of transmigration. They further stated that it is possible for the unerupted canine to deviate from its normal development site, move to a horizontal position, and migrate through the symphyseal bone, only if there is enough space available in front of the mandibular incisor roots. In the majority of cases, such a migrated tooth remains impacted; however, it may sometimes erupt later in its new position [1,2,4,6].

Intraosseous movement of an unerupted tooth across the midline of the jaw is known as dental transmigration [1,3]. According to some definitions, a true transmigration is when a tooth is migrated by more than half of its length from the midline [4]. The mandibular canines are the most comondental group presenting this rare phenomenon which seems to have an unclear etiology [5,7]. A transmigrated tooth can involve its adjacent teeth and cause root resorption, inclination, calcific metamorphosis or other pathological conditions[8]. It can also be surrounded by radiolucent area indicative of a cyst [6,7]. However, some of them show no pathologic change such as cases reported by Aras et al. [9]. According to the mentioned probable complications caused by transmigrated tooth, it seems substantial to diagnose this dental anomaly by radiographs and try to give the best treatment plan in order to minimize the subsequent complications as soon as possible. The aim of this Article to report two new cases of transmigrated mandibular canineand review the literature regarding the etiology and treatment.

In most reports of transmigrated teeth they were found in a horizontal position, below the apices of the erupted teeth [6]. Clinical and radiographic examination is usually required to diagnose transmigrant, because they are usually found within the symphysis of the mandible. Transmigrating teeth usually remain impacted and asymptomatic or they can cause pressure resorption of roots or tilting of adjacent teeth [3].

All of the transmigrated canines described were located in the mandible. Zvolanek was not able to establish a statistical significant incidence of canine transmigration after reviewing the dental records and radiographs of 4000 patients, among whom no new cases were identified [10].

In a review of 4500 panoramic radiographs, Aydin et al. identified 14 transmigrated canines (0.31%) (8 mandibular canines and 6 maxillary canines) [11]. Aydin and Yilmaz were the first to publish a case report of a maxillary transmigrated canine. Transmigration of an impacted maxillary canine is a very rare condition [5,11].This may be due to the negligible distance between the apexes of the maxillary canines and the floor of the nasal fossae, and to the presence of the midpalatal suture, which is a considerable barrier against maxillary canine migration [5,11].

The transmigrated teeth were classified (Mupparapu M) based on their migratory pattern and the final position within the jaw when diagnosed.

The following criteria were used to classify the transmigrated canines:

Type 1: Canine positioned mesio-angularly across the midline within the jaw bone, labial or lingual to anterior teeth, and the crown portion of the toothcrossing the midline.

Type 2: Canine horizontally impacted near the inferior border of the mandible below the apices of the incisors.

Type 3: Canine erupting either mesial or distal to the opposite canine.

Type 4: Canine horizontally impacted near the inferior border of the mandible below the apices of either premolars or molars on the opposite side.

Type 5: Canine positioned vertically in the midline (the long axis of the tooth crossing the midline) irrespective of eruption status

Type 1 is the most common type among the cases reported in the literature and type 2, type 4, type 3 and type 5 follows this, respectively.

Even though the teeth have transmigrated to the contralateral side, they maintain their nerve connection to the originating side. Therefore, it is important to anesthetize the nerve on the originating

side. In addition, like any other impacted teeth they have an increased chance of acting as foci of cyst, tumors or infection [12].

Treatment options proposed for transmigrated mandibular canines are surgical removal, transplantation and surgical exposure with orthodontic alignment. Surgical extraction is the most favoured treatment. If the patient is symptomatic and has any associated abnormalities, such as a developing apical cyst, neuralgia, resorption of an adjacent tooth root or displacement of teeth, then surgical extraction should be planned immediately. If the patient is asymptomatic, the transmigrated canine can be left in place; however, regular follow-up with radiographs is required to monitor movement of these teeth [1,3,5,13].

Case Reports

There is several treatment options proposed for unerupted mandibular canines.

Surgical removal

Surgical extraction appears to be the most favored treatment for migrated canines, rather than a heroic effort to bring the tooth back to its original place. This is especially true when the mandibular arch is crowded and requires therapeutic extractions to correct the incisor crowding. Thoma stated that transmigrated canines usually have to be removed [14]. Fiedler and Alling also recommend the extraction of transmigrated canines [15].

The adjustment of displaced mandibular canines, Although biomechanically possible, as they consist of mostly necessary pronounced tooth movement, and the narrow jaw width leads for iatrogenic damage to adjacent teeth or poor periodontal conditions. Moreover, since the canines are very often strongly shifted, the orthodontic adjustment is only indicated in exceptional cases.

In cases with impacted mandibular canines, the therapy is limited mostly to the extraction of the impacted tooth. Then, given an appropriate situation of orthodontic space closure done. (Fig. 1a-c).

Exposure and orthodontic alignment

Wertz used orthodontic treatment to bring a labially impacted transmigrated canine into position. However, if the crown of such a tooth migrates past the opposite incisor area or if the apex is seen to have migrated past the apex of the adjacent lateral incisor, it might be mechanically impossible to bring it into place [16]. Abbott et al described the transposition of an incompletely erupted permanent right canine to a position between the permanent left canine and the left lateral incisor and indicated that the tooth was amenable to orthodontic treatment. They suggested that the premature extraction of first premolars should be avoided when radiographs demonstrate the presence of an overly mesially angulated unerupted canine that has begun to migrate labially across the incisors. In these cases, it may be impossible to bring the canine to its correct position [17].

Taguchi et al reported considerable improvement in the position of those canines associated with an odontoma, after removal of the odontoma and surgical exposure [18].

In a 15-year-old patient the primary tooth 83 persistent. In region 43, a slight swelling was compared to the contralateral side, buccally palpated. on the X-ray an odontoma was seen in region 43, which had led to the relocation and retention of the permanent canine (Fig. 2a-d).

After surgical removal of the odontoma and the surgical exposure of the tooth 34 (Closed Exposure) with the titanium head and titanium chain (Fig. 2 e.) was the orthodontic adjustment (Fig. 2 f, g). At the beginning of the treatment, the active eruption was carried out using a plate and light elastics. For the final position of the tooth 43 was carried out with the brackets and tension springs. Clinically, was to see a recession on the adjusted tooth (Fig. 2 h-j).

Transplantation

If the mandibular incisors are in a normal position and space for the transmigrated canine is sufficient, transplantation may be undertaken. Howard transplanted a transmigrated canine when there was enough space to accommodate the tooth [1,2,3].

Fig.1.a. Orthopantogram: Horizontal displacement of the tooth



Fig.1.b43, Transmigration over the mandibular midline

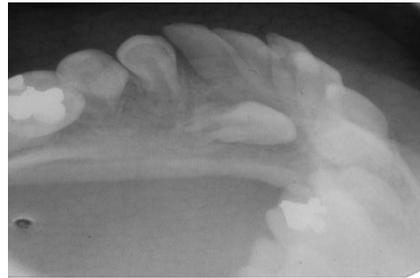


Fig. 1c Situation after extraction of tooth 43 and space closure.



Fig.2.a- Intraoral views at the beginning of the treatment



Fig.2.a-c Intraoral views at the beginning of the treatment



Fig.2.a-c Intraoral views at the beginning of the treatment



Fig.2d Orthopantomogram : Odontoma in the region of 43, Mesio-angular transmigration of the tooth 43.



Fig.2e the situation after extraction of the odontoma and tooth 83, exposure of tooth 43



Fig.2f during the treatment phase with a multi-brackets



Fig.2g Orthopantomogram



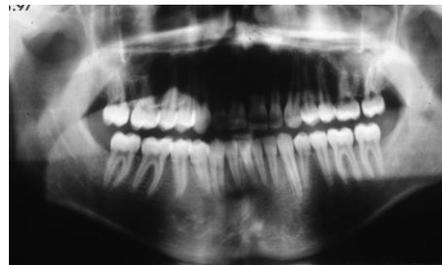
Fig.2h-i Intraoral views at end of the treatment



Fig.2h-i Intraoral views at end of the treatment



Fig.2j Orthopantomogram at the end of the treatment



DISCUSSION

There are several treatment options proposed for impacted mandibular canines including surgical removal, exposure and orthodontic alignment, transplantation and observation. Some authors believe asymptomatic impacted teeth can be left in place, but in these patients a series of successive radiographs should be taken periodically. Observation of impacted mandibular canines may be indicated in the following circumstances [11,12].

A systemic contraindication to a surgery exists;

- There is a deeply impacted asymptomatic mandibular canine with no associated pathology, particularly in an older patient.
- Whenever the patient has a satisfactory dental appearance and does not want surgical intervention.
- If the deciduous canine has a good root length and it is esthetically acceptable observation of an asymptomatic mandibular canine can be recommended.

Surgical extraction is necessary in the following situations;

- The existence of infection, cyst, or tumor related to the impacted canine.
- The impacted tooth causes the periodontal disturbance of the adjacent teeth.
- The presence of neuralgic symptoms.
- Crowding of the mandibular arch requiring therapeutic extractions to correct crowded incisor teeth.
- The impacted canine is ankylosed and cannot be transplanted.
- There is evidence of root resorption affecting the adjacent teeth.
- The root of impacted canine is severely dilacerated.
- Severe impaction of canine tooth.

- Patient rejection of orthodontic treatment or transplantation.

From the radiographs in cases 1 and 2, it can be seen that:

- Eruption initially appears normal.
- The tooth deviates for no apparent reason.
- The greatest amount of movement occurs during the pubertal age, where alveolar growth is at its maximum. This is also the case for normally erupting teeth. The direction of movement is usually mesial; however, distally and lingually ectopic canines are also seen.
- Occlusal movement of the tooth ceases. A mesial and apical path of movement is established, which worsens with time. As alveolar growth continues, the tooth becomes progressively buried.

Most of the published articles in the literature present just single cases. Transmigration of an unerupted tooth is generally a unilateral phenomenon, although 16 cases of bilateral transmigration have been reported [19]. In three out of four cases in the present report, left canines were involved unilaterally, and one case a bilateral canine transmigration was evident.

Transmigration of canines has been reported more frequently in females than males in a ratio of 1.6:1 and the mandibular left side is affected more than the right side [20]. The larger cross-sectional area of the anterior mandible compared with the anterior maxilla may be a reason for the higher frequency of mandibular canine transmigration [4].

There are many and varied etiological factors involved in the transmigration of teeth such as ectopic growth of the tooth bud, retention or premature loss of a primary tooth, inadequate eruption space and excessive length of crown. Genetic factors, endocrine disorders and trauma have also been proposed as etiological factors. Malignant anatomical structures [5].

Clinically, transmigration can be, and usually is, symptomless. Although the first published cases were detected as a result of neurological changes caused by the compression of the lower dental nerve by the impacted tooth [10], radiology has made it possible to detect other similar, but symptomless, cases, allowing an adequate assessment of the percentage of cases which are presented clinically.

The presence of pathological conditions with transmigration must also be mentioned. The most frequent of these conditions are the presence of dentigerous cysts, odontomas and the appearance of other impactions.

Treatment considerations for transmigratory teeth depend on the stage of development, distance of migration and the symptoms. When the root apices are closed, extraction often is the only choice. Clinical clues can help to diagnose this problem at an early stage to avoid extraction. Axial inclination of the canines can help to predict the likelihood of canine impaction and transmigration [8]. Canines lying within 25° to 30° of the midsagittal plane have a tendency for impaction, but they do not migrate to the midline. If canines are within an angle of 30° to 50°, they tend to cross the midline yet those that are found at an angle greater than 50°, transmigration is almost always the rule.

Stafne found that the greatest amount of tooth migration occurred before the root is completely formed. If these malpositioned teeth can be detected early, they may be surgically exposed and moved using orthodontic forces [21].

Ando et al suggested the premature loss of teeth, inadequate space, and excessively large crowns as etiological factors. However, premature extraction of the deciduous canine is practiced in an attempt to correct the eruption of an ectopic permanent canine [22].

Thoma reported cases in which a radiolucent area resembling a cystic lesion surrounded the transmigrated canine. However, it is difficult to say whether these pathological conditions were responsible for the transmigration or whether the pathological condition occurred after the migration of the canine [14].

Vichi and Franchi reported agenesis of the adjacent teeth, especially the lateral incisor, to promote retention of the deciduous canine so that the increased space in the dental arch may be attributed for absence of guided eruption. They observed proclination of the lower incisors, increased axial inclination of the unerupted canine, and an enlarged symphyseal cross-sectional area of the chin in nearly all their cases. They suggested that these factors could play an important role in the mechanism of transmigration.

They further stated that the unerupted canine has the possibility of deviating from its normal developmental site, moving to a horizontal position, and migrating through the symphyseal bone only if enough space is available in front of the lower incisors [23].

Greenberg and Orlian, over a 30 month period, followed the transmigration of a normally positioned unerupted mandibular left canine to a position of horizontal impaction below the apices of the four incisors [24]. Nodine reported that impacted and migrated mandibular canine is often discovered without having produced any apparent symptoms suggestive of their presence [25].

Caldwell and Bruszt provided neurological evidences that the canines did not develop in the region in which they were found but had migrated there from a position in or near their correct developmental site [26].

Sutton described a process wherein the canine, for some unknown reason, deviates to a horizontal position and an abnormally strong eruptive force directs the crown through the dense mandibular symphyses to the other side. Some other factors are; - retention or premature loss of primary teeth, crowding, spacing, supernumerary teeth and an excessive crown length of mandibular canine [27].

Mitchel presented reports of cases in which the probable etiology of the displacement of a lower canine was through the developing crypt. Although association of trauma and the displacement of the lower left canine could be co-incident, this seems unlikely. In cases of impacted mandibular canines where periapical radiographs fail to detect any abnormality (with no history of extraction), transmigration of canines should be suspected [28].

Shapira and Kuftinec stated that this abnormality was usually accompanied by a cyst or odontoma [20]. Al-Waheidi suggested that the canines were usually associated with cystic lesion and the presence of a cyst at the crown of canine might facilitate the migration process [28].

Joshi states that it was difficult to differentiate whether these pathological conditions were responsible for transmigratory process or vice-versa happened. In the cases we present, no pathology of any cystic type is reported through the radiograph. This shows that it is not necessary that transmigration is associated with pathology [8].

Buyukkurtet al reported a case in which an extraoral submental approach was planned. It should be noted that innervations of the transmigrated tooth is from the original side. Hence, an anesthesia of the originating side is essential during surgical treatment [29].

Wertz described the only published paper that illustrates a successful attempt to bring transmigrated canine into their normal place. Wertz concluded that although it is difficult, it is possible to bring impacted transmigrated canine positioned to labial to its normal position [16].

Gonzales et al. observed over-retained deciduous canine in one third of their cases indicating the presence of migrated canine. Other clinical features founded in some cases are the shift of dental midline to the affected side and proclination of mandibular incisors, especially in those which the impacted canine is remained in the symphyseal area. In our second case, the mandibular dental shift and in our third case, the over-retained primary canine, werethe relevant clinical findings [30].

Howard transplanted a transmigrated canine when there was enough space to accommodate the tooth. For a successful orthodontic treatment, a migrated tooth must be detected in early stages, otherwise treatment will be complicated. In the of case of transmigrated canine, surgical extraction may sometimes be the only favoured treatment [31]. The presence of roots of adjacent teeth immediately superior to the migrated tooth and the narrow dimensions of the mandible, there may be inadequate room for successful orthodontic maneuver [31].

One last treatment option in these patients is observation and clinical check ups, with radiographs taken periodically. In patients under 14 years old, before extracting the tooth, other options should be considered and the case should be carefully assessed. In patients over 14 years old, significant changes are not expected and extraction should only be considered if the patient rejects surgical treatment [2,5,6].

In the case in question, given the location of the canine, the orthodontist felt it to be more prudent to complete orthodontic treatment using a deciduous canine as a permanent tooth, and given that the

canine apices were closed, to advise against transplantation and suggest extraction. The patient was informed of all the aspects of his treatment, and of the possibility of premature loss of the deciduous canine, which would have to be covered with an osseointegrated implant in the said position [27].

Once transmigration is established extraction of impacted canine may be a treatment of choice.. Although the tooth is extracted on the contralateral side to the transmigrated canine, the tooth maintains its nervous innervation on the side that the germ is formed. This must be taken into account during the process of tooth extraction [16,26,27].

Camilleri and Scerri stated that when the mandibular incisors are in a normal position and space for transmigrated canine is sufficient, autotransplantation may be undertaken. However, an immature tooth is required for success, and the difficulty in removing the tooth in one piece complicates the procedure [31].

Experimental studies have shown that the loss of periodontal attachment does not occur during orthodontic tooth movement providing the periodontium is maintained in a healthy state [32]. However, in clinical studies, the variable loss of periodontal support is observed which may reflect the hygiene challenge associated with fixed orthodontic appliances. Except this condition, various periodontal problems can occur due to the surgical approach. Either an open or a closed surgical approach can be used to uncover the crown of impacted tooth and to place an orthodontic attachment. Open approach may lead to gingival recession, bone loss, decreased width of keratinized gingiva, delayed periodontal healing and gingival inflammation. With close approach method, less complications and more esthetically pleasing results are obtained [33,34].

Resorption is the most frequently occurring complication after tooth transplantation. Three types of resorption are distinguished:

- Surface root resorption
- Replacement resorption, also known as progressive ankylosis
- Inflammatory resorption.

Early detection and appropriate intervention can prevent the possible future complications caused by the transmigrated teeth. Therefore, clinical evaluation followed by a detailed radiographic screening is vital to achieve an accurate diagnosis of these teeth and optimal management [35,36,37].

CONCLUSION

In conclusion, according to literature there is no consensus on the definition of true cases of transmigration and impacted teeth. Migration of the canine through the midline is a rare phenomenon and usually it is asymptomatic. The diagnosis of transmigrated canines is based on the absence of the permanent canine in the dental arch and on the radiographic findings in both intraoral and panoramic radiographs.

Early examination aids in proper treatment planning to provide well aligned teeth in the dental arches, and avoiding future complications.

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