

Unusual intraosseous transmigration of impacted tooth

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ABSTRACT

Transmigration of an impacted tooth through the symphyseal suture is a rare and special developmental anomaly of unknown etiology that is unique to the mandibular canine. Maxillary canine transmigration is even rarer. Transmigrated canines are particularly significant due to the aesthetic and functional importance. A maxillary lateral incisor crossing the mid-palatal suture has never been reported in the literature. The aim of this report is to present the first case of simultaneous transmigration of a lateral incisor and canine in the maxilla. The paper also reports four unusual cases of unilateral canine transmigration in the maxilla and mandible and successful eruption of one of the transmigrated mandibular canines following orthodontic traction. Etiology of transmigration and its clinical considerations are also discussed. (*Imaging Sci Dent* 2012; 42 : 47-54)

KEY WORDS : Cuspid; Tooth, Impacted; Tooth Migration

Intraosseous migration of unerupted tooth is a rare and unusual dental anomaly which occurs mostly in the permanent dentition of the lower jaw. When the tooth crosses the midline, this rare phenomenon is known as dental transmigration and it occurs almost exclusively with mandibular canines with an incidence of 0.34%.¹ The mandibular permanent lateral incisor is the most frequently displaced tooth which usually migrates distally in the bone, and it crosses the midline very rarely.² Camilleri² reported the first case of lower lateral incisor transmigration coupled with lower canine transmigration in 2007. Although maxillary canine impaction is a well-known dental anomaly, there were a few reports of cases which showed migration across the mid-palatal suture to the opposite side of the maxilla recently.^{1,3-8}

The etiology and exact mechanism of the transmigration

is still unclear. Transmigrating teeth can cause pressure resorption of roots or tilting of the adjacent teeth and may migrate to adjacent structures like the coronoid process, causing pain and discomfort to the patient.⁹ Since impacted or transmigrated teeth are important especially in terms of orthodontic treatment planning, these teeth must be diagnosed clinically and radiographically. Early diagnosis with a timely orthodontic or surgical intervention can help dentists preserve the canines, which play an important role, in both esthetics and function in the human dentition.

Due to unfavorable position of the transmigrated canine, orthodontic repositioning is difficult. Until now, successful corrections of transmigrated canines using orthodontic treatment have rarely been documented in the literatures.^{10,11} To the best of our knowledge, maxillary lateral incisor crossing the mid-palatal suture has never been reported in the literature. Multiple transmigrations are even rarer.

This report demonstrates a case of simultaneous transmigration of a lateral incisor and canine in the maxilla. It also reports four unusual cases of unilateral canine transmigration in the maxilla and mandible and successful eruption

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tion of one of the mandibular transmigrated canines following orthodontic traction. Etiology of transmigration and its clinical considerations are also discussed.

Case Report

Case 1

A 14-year-old female reported to the department with a complaint of crowding of the upper teeth. Intraoral examination showed the absence of the maxillary right permanent lateral incisor and canine. A maxillary occlusal radiograph revealed double transmigration of both upper right lateral incisor and canine which were impacted (Fig. 1). In order to evaluate the extent of the transmigration process, axial computed tomographic (CT) images were acquired from the maxillofacial region along with three dimensional reconstructions using CT equipment (Brilliance CT 64-channel scanner, Philips Healthcare, Andover, MA, USA). CT images revealed that the maxillary right lateral incisor

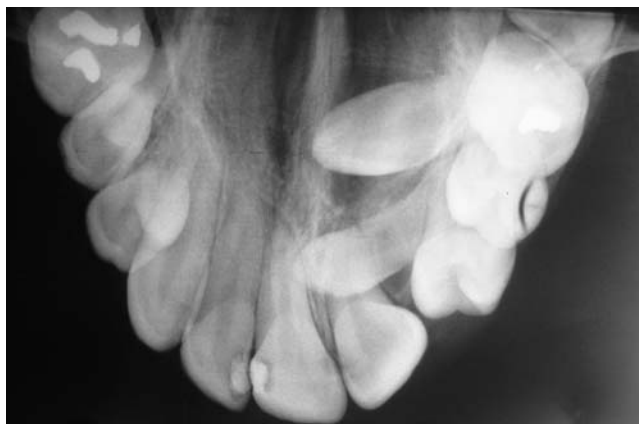


Fig. 1. Maxillary Occlusal radiograph shows a horizontally impacted upper right lateral incisor and canine crossing the mid palatal suture with pericoronal radiolucency in relation to canine.

was impacted horizontally and was positioned on the palatal side. Its crown had migrated across the mid palatine suture with its cusp tip against the middle third of the root of the upper left central incisor. The maxillary right canine was almost impacted horizontally and transmigrated across the mid palatine suture to the left side, with its crown near the root apex of the left central incisor. CT images showed pericoronal radiolucency in relation to the upper right canine suggestive of a dentigerous cyst, however no associated pathology was found in relation to the transmigrated upper right lateral incisor (Fig. 2). Due to the unfavorable position of the transmigrated teeth and associated pathology, surgical removal was decided. Extractions were performed under general anesthesia (Fig. 3). Healing was uneventful and a follow-up radiograph 8 months after the surgery showed no further abnormality (Fig. 4).

Case 2

A 24-year-old female reported to the department with a chief complaint of spacing between the upper right lateral incisor and first premolar. Intraoral examination showed that the upper right permanent canine and all the third molars were absent. Panoramic radiograph revealed a transmigrated upper right canine which was impacted almost horizontally at the level of the apical third of the roots of the upper central incisors. The crown migrated across the mid-palatine suture with its cusp tip against the root of the upper left central incisor. Transmigration was also confirmed on the maxillary occlusal radiograph (Fig. 5). There was no pathologic finding associated with the tooth. Due to the unfavorable position of the canine, surgical removal of the canine was decided. However, the patient declined the surgical intervention. The patient was informed of the consequences and radiographic monitoring was strongly recommended.



Fig. 2. CT sections show a transmigrated maxillary right lateral incisor and canine with pericoronal radiolucency.

Case 3

A 22-year-old male patient was referred to our department for an orthodontic consultation. Intraoral examination showed the absence of the permanent canine and lateral incisor in the upper right quadrant. The lower left permanent canine was also absent and the deciduous canine was retained in the lower left quadrant (Fig. 6A). As the patient did not report any history of extraction or traumatic avulsion of teeth, further investigation was done by panoramic, occlusal, and periapical radiographs. Radiographic examination revealed the presence of a migrated lower left canine with its crown located below the apices of the right central incisor. The upper right canine was impacted vertically and the lateral incisor was congenitally absent (Fig. 6B). As both impacted canines were in favorable position, surgical exposure, followed by orthodontic traction was started to bring the canines into the arch. One year later,



Fig. 3. The extracted maxillary right lateral incisor and canine.

the upper right canine was well placed into the arch and transmigrated canine erupted in the oral cavity (Fig. 7). A prosthetic implant would be placed for the missing lateral incisor after the completion of orthodontic treatment.

Case 4

A 20-year-old male reported to a dental clinic for a routine dental check up. Oral examination revealed a retained lower deciduous canine on the left side. On further examination, panoramic radiograph showed a horizontally impacted lower left permanent canine. It was transmigrated across the midline to the right side with its crown position near the inferior border of the mandible below the root apices of the right second premolar and permanent first



Fig. 4. Maxillary occlusal radiograph shows normal healing state after 8 months.



Fig. 5. Panoramic and maxillary occlusal radiograph show a transmigrated upper right canine horizontally impacted with its cuspal tip against the root of the upper left central incisor.

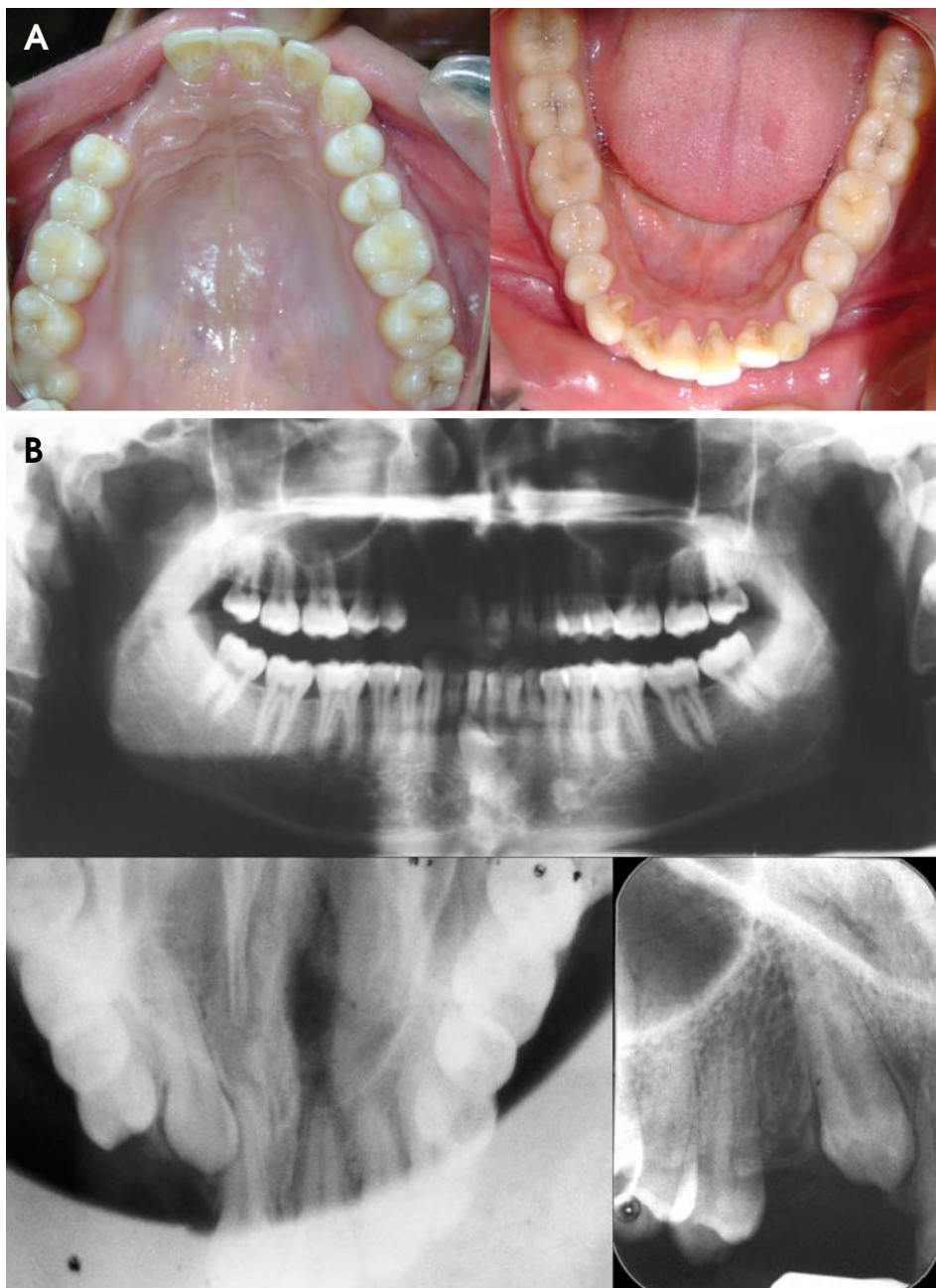


Fig. 6. A. Intraoral photographs show missing lateral incisor and canine in the right upper quadrant. B. Panoramic, maxillary occlusal, and periapical radiographs show an impacted upper right canine and transmigration of a lower left canine with its crown located below the apices of the right central incisor.



Fig. 7. Successful eruption of the impacted canines following orthodontic traction.



Fig. 8. Panoramic radiograph shows a transmigrated horizontally impacted left canine near inferior border of the mandible with its crown's position below the root apices of right second premolar and first molar.



Fig. 9. Panoramic radiograph shows a transmigrated lower left canine with its crown located below the apices of right premolars.

molar (Fig. 8). As there was no pathology associated with the tooth, periodic radiographic follow up was decided.

Case 5

A 22-year-old female patient was referred to our department for orthodontic consultation. Intraoral examination showed a missing permanent left lower canine. Panoramic radiograph examination revealed a migrated lower left canine with its crown located below the apices of the right premolars (Fig. 9). Enlarged follicular space was found around the migrated canine. As there was no associated symptoms, periodic radiographic follow up was decided.

Discussion

Tarsitano et al¹² defined transmigration as a phenomenon in which an unerupted mandibular canine migrates, crossing the mandibular midline. Javid¹³ expanded the definition to include the cases in which more than half of the tooth

had passed through the midline. Joshi⁹ and Auluck et al¹⁴ suggested that the tendency of a canine to cross the midline suture is a more important consideration than the actual distance of migration after crossing the midline. Moreover, it will also depend on the stage of transmigration when the orthodontist or oral surgeon first finds the patient. Therefore, we adapted their criteria to define the transmigration in our study.

Maxillary canine transmigration in Indian population has never been reported in the literature. Here we have presented two cases of maxillary transmigration from Indian people. Case 1 presented here showed many rare features. This unusual phenomenon has mostly been described and documented for the mandibular canine. The first published case of mandibular lateral incisor transmigration was reported in 2007,² however a case of maxillary incisor transmigration has been never reported in the literature. Transmigration is rarely found in the maxillary arch. Aydin and Yilmaz³ reported the first case of maxillary canine trans-

Table 1. Studies related to maxillary canine transmigration in chronological order

Author, year	No. of cases	Age (year)	Side (Left/Right)	Sex (M:F)	Eruption status	Primary canine	Uni/Bi	Treatment protocol	Associated pathology/Remarks
Aydin et al, ³ 2003	1	31	L	F	I	CR	Uni	Observation	None
Aydin et al, ⁴ 2004	6	16-74 (Mean-38.67)	3R,3L	M-3,F-3	I-5 E-1	3CR 3CE	Uni	Observation-4 case Extraction-2 case	Microdontia and agenesis of lateral incisor, impaction of contralateral canine
Ryan et al, ⁵ 2005	1	NA	L	NA	I	NA	Uni	NA	Cleft palate
Shapira et al, ⁶ 2005	1	16 year	R	M	I	CR	Uni	Observation	Impacted upper left canine
Aras et al, ⁷ 2008	12	15-57 (Mean-31.5)	R-6,L-6	6M,6F	I	10 CE, 2CR	Uni	Extraction-10, Transplantation-1, Observation-1	None
Aktan et al, ⁸ 2010	7	17-62 (Mean-37.1)	R-3,L-3, Midline-1	M-3,F-4	I	CR-1, CE-6	Uni-7	Not mentioned	None
Celikoglu et al, ⁹ 2010	1	NA	R	M-1	I	CE	Uni	Extraction	Impacted Mesiodens

L: left, R: right, F: female, M: male, I: impacted, CR: retained primary canine, CE: exfoliated primary canine, Uni/Bi: unilateral/bilateral, NA: Not available.

migration in the literature in 2003. A chronological resume of the clinical features of the transmigratory maxillary canine, as observed by various earlier authors, is given in Table 1. In all of the previously published cases, isolated maxillary canine transmigration was reported. The case 1 was the first report where unilateral maxillary canine transmigration was seen along with the adjacent lateral incisor transmigration.

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. In the maxilla, transmigration of canines might be prevented due to the shorter distance between the roots of maxillary incisors and the floor of the nasal fossa and restriction of the path of tooth movement by the roots of adjacent teeth, the maxillary sinus and the mid-palatal suture, which act as a barrier.⁶

In 2002, Mupparapu¹⁵ proposed a classification for transmigrated mandibular canines according to their migratory pattern and position in the jaw and classified these teeth into five groups. This classification can be summarized as follows:

Type 1, canine is impacted mesioangularly across the midline, labial or lingual to the anterior teeth, with the crown portion of the tooth crossing the midline. Type 2, canine is horizontally impacted near the inferior border of the mandible below the apices of the incisors. Type 3, canine has erupted either mesial or distal to the opposite canine. Type 4, canine is horizontally impacted near the

border of the mandible below the apices of either premolars or molars on the opposite side. Type 5, canine is positioned vertically in the midline with the long axis of the tooth crossing the midline. The most common transmigratory pattern reported in the literature was type I and type 5 being the least common. The radiographic appearance of the transmigrated canines in Case 4 and 5 was in accordance with type 4, whereas type 1 transmigratory pattern was seen in Case 3. Transmigrated maxillary canines could not be classified as there was no classification system proposed until now in the literature.

The etiology and exact mechanism of transmigration is still not clear. Although a number of factors have been suggested, abnormal displacement of the dental lamina in embryonic life is a commonly accepted explanation of the cause of the displacement and non-eruption of such canines.⁹ Marks and Schroeder¹⁶ suggested that a regional disturbance in the dental follicle might lead to local defective osteoclastic function with an abnormal eruption pathway being formed. Bruzst¹⁷ believed that the canine germ was situated in front of the lower incisors and that facial growth pushed it towards the contralateral side while other authors¹⁸ believed that an abnormally strong eruption force or a change which affected the crypt of the tooth germ might lead to erroneous eruption. According to Pippi and Kaitsas,¹⁹ a strong and extended eruptive force caused by lasting root formation, and a pericoronal osteolytic area caused by widening of the follicular space played an important role in intraosseous migration of canines. The authors

proposed that following impaction, these two factors could cause the anomalous movement of the canine. The osteolytic area is believed to represent a site of less resistance, toward which the tooth moves while root formation takes place. Hence, the simultaneous occurrence of these two events is believed to cause the intraosseous movement of the canine (in the opposite direction to the root) until a mechanical obstacle is reached (such as the cortical bone), or when the pericoronal osteolytic area dissipates.

Other local or pathologic factors suggested in the aetiology of transmigration, are premature loss of primary teeth and unavoidable occupation of the space by adjacent teeth, retention of the deciduous canine, discrepancies of tooth size, unfavorable alveolar length, genetics, trauma, tumors, odontomas, cysts and even a very small obstacle, such as a small root fragment, that would be sufficient to divert a tooth from its normal path of eruption.⁹ According to Auluck and Mupparapu,²⁰ the angulation of the migrating maxillary canine relative to the mid-palatal suture might be an important factor in determining their transmigration. Impacted maxillary canines require a large amount of force to overcome the strong barrier, the mid-palatal suture, in their path. When the maxillary canines are positioned perpendicular to the mid-palatal suture, they might have enough horizontal component of eruptive force to migrate to the contralateral side. However, when they are positioned at an axiocoronal angulation ie, 45° to 90° the eruptive force will have both vertical and horizontal (angular) components. The horizontal component of the eruptive force of such an impacted maxillary canine might not be sufficient to overcome the resistance of the mid-palatal suture, and thus these teeth abruptly abandon their journey at the midline. In the cases presented here, all the maxillary transmigrated teeth were positioned almost perpendicular to the midline, facilitating their transmigration, except in case 2 where the canine was transmigrated to contralateral side with an axio-coronal angulation of less than 90 degree (Fig. 5).

Canine just migrates without any pathological entity mostly, however in a few cases a cyst or odontoma accompanies such a tooth. In case 1 presented here, the transmigrated canine was associated with a dentigerous cyst.

Canine transmigration is of significant importance in dentistry, creating orthodontic, surgical, and interceptive problems. These cases have been increasing day by day. It is important to diagnose them in earlier stages of migration or abnormality to prevent more complicated situations. Vichi and Franchi²¹ suggested that, proclination of the lower incisors, increased axial inclination of the unerupted

canine, and an enlarged symphyseal cross-sectional area of the chin may be favorable conditions for the transmigration. All of these features found in 8- to 9-year-old patient demand periodic panoramic examination to rule out transmigration. Surgical removal, transplantation, radiographic follow-up, and surgical exposure with orthodontic treatment are suggested as treatment options for transmigrated canines.⁷ Orthodontic correction of impacted transmigrated canines is difficult due to unfavorable position of the impacted tooth. Until now, successful corrections of transmigrated canines using orthodontic treatment have been rarely documented in the literature.^{10,11} In Case 3, the impacted transmigrated canine was erupted successfully after orthodontic traction and its alignment is still in progress (Fig. 7).

If surgical removal is considered as the choice of treatment, it should be kept in mind that, although the teeth have transmigrated to the other side of the midline, they still maintain their nerve supply from the originating side.⁹ This is an important factor in planning any surgical procedure under local anesthesia either to expose and bond or extract the transmigrated tooth.

In conclusion, the mechanism of transmigrated maxillary canines passing to the contralateral side of the mid-palatal suture needs to be further studied. Clinicians should be encouraged to report more cases of transmigrated maxillary canines to better understand their mechanism of eruption which will aid in the diagnosis, prevention and treatment of these occurrences.

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