A rare case of canine anomaly – a possible algorithm for treating it

LIGIA VAIDA1), BIANCA IOANA TODO1), CLAUDIACOREGA2), MIHAELA BĂCIUȚ3), GRIGORE BĂCIUȚ4)

1) Department of Dentistry, Faculty of Medicine and Pharmacy, University of Oradea, Romania
2) Department of Orthodontics, “Iuliu Hâțieganu” University of Medicine and Pharmacy, Cluj-Napoca, Romania
3) Department of Implantology and Maxillofacial Surgery, “Iuliu Hâțieganu” University of Medicine and Pharmacy, Cluj-Napoca, Romania
4) Department of Oral and Maxillofacial Surgery, “Iuliu Hâțieganu” University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract
Canine transmigration is a very rare dental anomaly in which an unerupted mandibular canine migrates, crossing the mandibular midline. This unusual condition is most often diagnosed by chance during a routine X-ray examination. The most common clinical signs announcing the presence of this anomaly are over-retention of the deciduous canine and the absence of permanent canine from the dental arch after its physiological period of eruption. In this paper, we present a clinical case, 10-year-old boy, who was diagnosed with mandibular right canine transmigration at three years after the start of orthodontic treatment, during which we were expecting the eruption of mandibular canines. The orthopantomograph revealed the mandibular right canine to be in a horizontal position under the apices of the incisors – type 2 transmigration pattern classified by Mupparapu (2002). Based on cone-beam computer tomography examination, we recommended a surgical exposure of the canine and orthodontic alignment. Due to the risk of root resorption of the mandibular right lateral incisor during orthodontic movement phase of canine transmigrated to the dental arch, we decided to align the mandibular right canine in a transposition, between the two mandibular right incisors. Then we resorted to adapting the mandibular right lateral incisor coronary morphology to simulate a canine and also to reshaping the canine coronary morphology to resemble a lateral incisor. This therapeutic approach allowed us to restore morphologically and functionally the mandibular dento-alveolar arch, preserving the entire dental system.

Keywords: transmigrated canine, orthodontic treatment, canine coronary morphology, laterals incisor coronary morphology.

Introduction
According to the literature, canine transmigration is a very rare and unusual dental anomaly [1–3]. Joshi (2001) defined transmigration as the migration of a tooth across the jaw midline without the influence of any pathological entity [4]. Tarasitano et al. (1971) suggested that transmigration is a phenomenon in which an unerupted mandibular canine migrates, crossing the mandibular midline [5]. According to Javid (1985), transmigration should be considered when half of the length of the crown crosses the midline [1].

The occurrence of transmigration of mandibular canines varies from 0.14% to 0.31% [6, 7]. While canine impaction affects the maxilla much more frequently than the mandible, canine transmigration is found more frequently in the mandible. Also, the unilateral canine transmigration is more common than the bilateral canine transmigration, especially at the mandible [1, 4, 6–8]. Aktan et al. (2010) reported incidence of maxillary canine transmigration as 0.14% and the incidence of mandibular canine transmigration as 0.34%, with the right side affected more often than the left side in both jaws [6]. There is clinical evidence where canine transmigration may be associated with transmigration of other teeth [9, 10].

The mechanism that causes this canine transmigration is still not clear [11]. However, there are some assumptions considering the following etiological factors: retention or premature loss of primary teeth, crowding, spacing, supernumerary teeth, cysts and tumors, and an excessive crown length of the mandibular canine [8, 12]. In the literature, there is no clear evidence to prove that the canine transmigration could be congenitally inherited.

In 2002, Mupparapu used five criteria to classify the transmigrated mandibular canines depending on its path of deviation. Type 1: Positioned mesioangularly across the jaw midline without influence of any pathological entity [4]. Type 2: Horizontally impacted near the inferior border of the mandible below the apices of the incisors (45.6%). Type 3: Erupting either mesial or distal to the opposite canine (14%). Type 4: Horizontally impacted near the inferior border of the mandible below the apices of either premolars or molars on the opposite side (17%). Type 5: Positioned vertically in the midline (the long axis of the tooth crossing the midline) irrespective of eruption status (1.5%) [13].

This paper aims at reporting a case of transmigration of mandibular canine, at discussing the importance of early diagnosis and treatment planning and at presenting our option for canine transmigration treatment in order to restore the mandibular dento-alveolar arch, morphologically and functionally.
by surgical exposure and orthodontic treatment. Unlike other cases of canine transmigration presented in the literature, in this case the transmigration of canine occurred during the period when the patient was under orthodontic treatment.

The patient, a 10-year-old boy, presented to our clinic in 2007 requiring treatment of dental crowding. During the clinical examination, we noticed the presence of mixed dentition, a delayed dentition, permanent teeth being only the first molars and incisors on both dental arches. The medical examination and treatment was conducted with the written informed consent of his mother who was also instructed regarding our intention to include this case in a scientific paper.

**First radiological examination**

Upon radiological examination (orthopantomograph – Figure 1), we found the presence of a mixed dentition, deciduous teeth presenting complicated decays and large coronary destructions. Intramaxillary, one could see the presence of all permanent teeth buds. In that period, we did not associate the slight mesial inclination of the mandibular right canine bud with a possible pathological evolution.

![Figure 1 – Orthopantomograph from the beginning of the orthodontic treatment: 10-year-old patient with mixed dentition.](image)

**Orthodontic treatment**

We started the orthodontic treatment of the maxillary dental arch with a removable appliance. In the mandibular dental arch, we found the presence of tooth eruption disorders with persistent deciduous canines after the eruption of second premolars (Figure 2).

After one year of treatment, during which the lateral incisors and premolars erupted in maxillary dental arch (Figure 3), we continued upper arch treatment with a fixed appliance without requiring the patient a new orthopantomograph for avoiding additional radiation.

Subsequently, we observed in the mandibular dental arch delayed left permanent canine eruption while the right deciduous canine continued to persist. Then, we decided to extract the deciduous mandibular right canine (Figure 4) and to start orthodontic treatment with fixed appliance in the mandibular dental arch.

**Second image examination**

We asked the patient to take a new radiological investigation after three years from the beginning of the treatment. Panoramic radiograph revealed the mandibular right canine to be in a horizontal position under the apices of the incisors – type 2 transmigration pattern classified by Mupparapu (2002) (Figure 5) [13]. This transmigrated canine was radiographically seen to be surrounded by a cystic lesion.

**Surgical exposure and orthodontic alignment of the canine**

As a result of a began cone-beam computer tomography (CBCT) examination (Figure 6), that revealed the presence of a dentiger cyst surrounding the transmigrated canine and its relationship with the neighboring anatomical structures, we decided to recommend a surgical intervention, in order to perform a canine exposure and bonding of attachment to allow subsequent orthodontic traction of the canine (Figure 7).

The canine distalization and uprighting were possible only using skeletal anchorage represented of mini-implant, otherwise there was a high risk to damage other teeth from the dental arch (Figure 8).

During orthodontic movement phase of canine transmigrated to the dental arch, we reassessed, using CBCT investigation, the canine position and its relationship with incisors roots. We noticed the risk of root resorption of the mandibular right lateral incisor. This observation led us to the decision to distalize the mandibular right lateral incisor in contact with the first premolar, by using orthodontic forces, and to align the mandibular right canine in a transposition, between mandibular right lateral incisor and mandibular right central incisor (Figure 9).

After aligning the mandibular right canine in the dental arch between the two incisors, we found a canine gingival retraction. CBCT revealed the lack of vestibular bone support of the canine. These findings led us to the need for intervention of canine periodontal surgery after removing the orthodontic appliance.

**Periodontal surgery procedure**

Based on clinical examination corroborated with paraclinical examination (CBCT), it was noticed gingival retraction at canine, Class 3 Miller, as well as bone loss at buccal alveolar ridge of the respective tooth. Using a bone collecting single use tool, it was taken autologous bone at the level of chin using the scraping technique. The approximately one square centimeter bone sample was used to cover the bone deficiency at the alveolar vestibular level of canine (Figure 10). Therewith were done horizontal excisions of ties scars and lower labial frenulum in order to avoid the possible subsequent tractions of the flap.

**Morphological and functional restoration of the dental arch**

Morphological and functional restoration of the mandibular dental arch at the end of the orthodontic treatment, according to this complete therapeutic transposition, involved adjusting the lateral incisor crown in order to give it the morphological aspect of a canine and also reshaping the canine coronary morphology to resemble a lateral incisor. For this purpose, we focused on the application of a veneer on the lateral incisor and composite angular addition on the canine crown (Figure 11).
A rare case of canine anomaly – a possible algorithm for treating it

Figure 2 – Mandibular dental arch: tooth eruption disorders (eruption of second premolar before canines’ eruption).

Figure 3 – Intraoral aspect before treatment with orthodontic fixed appliance: (a) Maxillary dental arch – lack of space for permanent canines’ eruption; (b) Frontal occlusion.

Figure 4 – Intraoral aspect after applying the maxillary fixed appliance: (a) Orthodontic treatment phase in the upper dental arch; (b) Mandibular dental arch after extraction of lower right deciduous canine. Note the delayed eruption of lower left canine in a severe disto-vestibular rotation.

Figure 5 – (a and b) Orthopantomograph after three years from the beginning of the treatment shows the lower right canine transmigration (red arrows) in a horizontal position under the apices of the incisors.

Figure 6 – (a–c) CBCT, the axial sections showing the anatomical relationship of transmigrated canine with the lower incisors roots.

Figure 7 – Intraoperative and postoperative aspect: (a) The osseous cavity after the enucleation of the dentiger cyst; (b) The first system of canine orthodontic traction to the dental arch.

Figure 8 – Orthodontic treatment phase, distalization of lateral incisor and orthodontic retraction of the transmigrated canine using a mini-implant.
Discussion

Migration of a tooth across the midline is a rare anomaly. However, at least 157 cases of mandibular canine transmigration were already published 10 years ago [3, 14, 15]. Until 2011, 196 cases of mandibular canine transmigration have been reported [16]. This anomaly creates surgical, orthodontic, interceptive and restorative problems.

The most transmigrated canines are asymptomatic and therefore the patients are not aware of this condition. Most of these transmigrated canines are usually detected during routine radiological examinations. In order to confirm the diagnosis, the following types of radiographs may be used: dental pantomographs, occlusal, periapical, lateral cephalometric and three-dimensional investigations (cone-beam computer tomography is likely to be preferred nowadays). However, there are some clinical signs of transmigration that have been reported, such as: over-retention of the deciduous canine, proclination of the mandibular anterior teeth, an enlarged symphyseal area, and chronic infection with fistulization [6, 11].

In our study, three factors might possibly cause the transmigration: over-retention of the deciduous mandibular right canine, mesial inclination of the canine bud and the presence of the dentigerous cyst.

There are several treatment options proposed for unerupted canines:

1. *Surgical removal* appears to be the most favorable treatment for transmigrated canines, rather than making effort to bring the tooth to its original place. This is especially indicated when the mandibular teeth are crowded and require therapeutic extractions to correct the incisor crowding [11].

2. *Surgical exposure and orthodontic alignment*. Few of the orthodontists succeeded successfully orthodontic alignment of transmigrated canines on the dental arch [17]. Wertz used orthodontic treatment to bring three labial transmigrated canines into position [18]. Kumar *et al.* (2012) reported success in orthodontic treatment of a transmigrated lower left canine, which was located with its crown below the apices of the right central incisor [19]. Camilleri and Scerri (2003) suggested that if the crown of such a tooth migrates past the opposite incisor area or if the apex migrated past the apex of the adjacent lateral incisor, it might be mechanically impossible to bring it into place [11].

3. *Transplantation*. If the mandibular teeth are not crowded, incisors are in a normal position and the space for the transmigrated canine is sufficient, transplantation may be a choice.

4. *Observation (radiographic monitoring)*. Transmigrated canines can be left in place and kept under observation until the appearance of the first symptoms such as the existence of pressure, roots resorption of the adjacent teeth, periodontal disturbances, prosthetic
problems, malposition of the adjacent teeth, neuralgic symptoms, a progressive worsening of the position of the canine or suggestion of cystic change. These symptoms represent indications for surgical interventions. In these situations, a series of successive radiographs should be taken periodically [12, 17, 20]. Most authors stated that transmigrated canines usually have to be removed rather than a heroic effort to reposition them to their original place [20–22].

Auluck et al. (2006) reported four cases of mandibular canine transmigration, all detected after the age of 20-year-old, of whom three symptomatic and one asymptomatic and emphasized the importance of early diagnosis and early treatment to avoid complications [23].

In the clinical case presented by us, mandibular canine transmigration occurred in a period of three years. Despite the fact that there was a mesial inclination of mandibular right canine bud with 39° (Figure 12), we did not suspect it then as a possible pathological evolution, so that we did not propose to follow the case from this point of view. The left mandibular permanent canine that delayed erupting led us to consider the existence of disturbances in the eruption sequence of the mandibular canines and, therefore, we did not ask the patient to take a new orthopantomography earlier than it could show the tendency to transmigration. Our study highlights the importance of clinical and radiological following of mandibular canines’ eruption especially when there is a more pronounced mesial tilt.

Figure 12 – The axial inclination of the mandibular right canine bud to mid-sagittal plane, α=39°, at the beginning of the orthodontic treatment (patient aged 10 years).

Because the canine migrated to the contralateral hemi arch, it was not possible to align it in its original position on the dental arch. Nevertheless, we succeeded to integrate it between the two mandibular right incisors. However, an acceptable outcome was gained that allowed us to obtain morphological and functional restoration of the mandibular dental arch with the conservation of the entire dental system and to achieve a functional occlusion to ensure optimum evolution of stomatognathic system.

According to Stafne (1963), the greatest amount of canine intraosseous movement takes place prior to completion of tooth root development – between the ages of 11- and 14-year-old [24]. Peck (1998) suggested that the intraosseous migration of a canine apparently starts earlier, during the early mixed dentition stage and may last many years [25]. If the diagnosis had been made even later, the transmigrated canine probably would have continued to move in the contralateral hemi arch to the premolar and molar region. Joshi (2001) suggested that the stage of transmigration will depend on the time of diagnosis [4]. Thus, Auluck et al. (2006) and Aktan et al. (2008) reported two cases of extreme transmigrated canines, where the canines were lying horizontally under the second molar and third molar on the opposite side [23, 26].

In our study, transmigrated canine orthodontic treatment would not have been possible without holding prior information provided by CBCT, a radiological investigation that revolutionized the bone analysis and treatment planning. The information revealed by CBCT is needed for a lot of purposes, such as: assessment of bone support; examination of teeth and facial structures to start orthodontic treatment; examination of the relationship between the impacted teeth and the neighboring anatomical structures; diagnosis of cysts, tumors or infections of the teeth and jaw bones [27, 28]. We requested a new CBCT investigation during orthodontic retraction canine phase to assess its position and its relationship with incisors’ roots.

Also, transmigrated canine orthodontic movement toward dental arch would have been extremely difficult, if not impossible, without the use of skeletal anchorage represented by mini-implant. Mini-implants are an excellent alternative to conventional orthodontic anchorage systems such as intraoral dental anchoring units, which run the risk of severely damaging the teeth. Other advantages include their relatively small size, which results in minimal anatomical limitations, user-friendly protocol, immediate loading potential, adaptability to biomechanics in effecting orthodontic and orthopedic forces, high success rate, low cost and, most importantly, patient acceptability. The use of orthodontic mini-implant simplified the treatment plan and allowed us a maximum conservation of tooth structures [29–31].

With respect to the treatment of these canines, interceptive treatment should be carried out, although it is extremely difficult, if not impossible, to predict the appearance of this anomaly. For Joshi (2001), predicting the appearance of this anomaly depends on the inclination that the canine tooth germ presents. If the angle formed by the mid-sagittal plane and unerupted canine is less than 30°, transmigration is unlikely. If the angle is between 30° and 50° unerupted canine may tend to cross the midline. When the angle exceeds 50°, crossing the midline becomes a rule [4, 32].

Sharma and Nagpal (2011) suggested that angulation of long axis of unerupted canine with mid-sagittal plane should always be evaluated in mixed dentition period. An early and timely intervention would lead to better management of the transmigrated canine and hence to avoiding the potential complications associated with transmigrated canine [16].

Vichi and Franchi [33] suggested that an 8- to 9-year-old patient with an excessive mesial inclination of the unerupted mandibular permanent canine germ should be kept under observation with periodical panoramic radiographic examinations. If the position of the unerupted mandibular canine is observed to tilt mesially progressively, interceptive measures should be taken. The preventive and interceptive treatment should include extraction of the retained deciduous canine and surgical exposure of the transmigrated canine followed by orthodontic treatment [20, 33]. According to this observation, our study emphasizes the importance of early diagnosis to correct this abnormality before the tooth migrates too far from its original place.
Conclusions

In the presentation of this case report, we intended to highlight the importance of a rigorous analysis of the position and mesial inclination of the lower canines’ buds in a routine radiological examination, such as orthopantomograph, and also the importance of proper investigation of persistent deciduous canines on dental arches. The transmigrated canine treatment success is conditioned by the early and correct diagnosis and an appropriate treatment planning, which often requires an interdisciplinary approach.

Author contribution

All the authors equally contributed to the drawing up of the present paper.

References


Corresponding author

Mihaela Băciuț, DMD, MD, PhD, Department of Implantology and Maxillofacial Surgery, “Iuliu Hatieganu” University of Medicine and Pharmacy, 37 Cardinal Iuliu Hossu Street, 400129 Cluj-Napoca, Romania; Phone/Fax +40264–450 300, e-mail: mbaciut@yahoo.com

Received: January 17, 2014

Accepted: October 17, 2014

Ligia Vaida et al.