

## Mandibular Canine Transmigration: Report of Three Cases and Literature Review

Mandeep K. Bhullar, Isha Aggarwal, Rashmi Verma, Amandeep S. Uppal<sup>1</sup>

Department of Orthodontics and Dentofacial Orthopedics, Gian Sagar Dental College and Hospital, Patiala, Punjab, <sup>1</sup>Department of Endodontics, HSJ Institute of Dental Sciences, Panjab University, Chandigarh, India

Received : 24-05-16.  
Accepted : 26-12-16.  
Published : 21-02-17.

### ABSTRACT

**Aims and Objectives:** Transmigration is a rare phenomenon seen almost exclusively in the mandibular canines. The aim of the present study is to review transmigration phenomenon.

**Materials and Methods:** Appropriate guidelines for a systematic review were followed. The time period selected for the present systematic review was 2001–2016. The studies were selected from various electronic databases on the basis of their title, study, design, keywords, and abstracts. A total of 150 citations were searched initially, and after proper screening, 59 relevant articles were included. Additional data was obtained by searching journals and reference lists.

**Results:** The literature search shows that transmigration is more frequent in the mandible than maxilla. The etiology of the condition is obscure; however, multiple factors have been attributed to the condition. They are more readily recognized now with the advent of panoramic radiographs. Transmigration is a rare anomaly causing varied manifestations and requires an interdisciplinary approach for management.

**Conclusion:** Early diagnosis of impacted canines is mandatory for timely treatment to ensure facial harmony and improved function.

**KEYWORDS:** Impaction, mandibular canines, multifactorial, transmigration

### INTRODUCTION

Intraosseous migration of unerupted teeth across the midline is a rare phenomenon known as dental transmigration. Ando *et al.* in 1964 coined the term transmigration.<sup>[1]</sup> Transmigration was defined as a phenomenon of the movement of unerupted canine through the midline by Tarsitano *et al.*<sup>[2]</sup> Impaction of maxillary canines is more prevalent, whereas transmigration is seen more commonly in the mandible.<sup>[3,4]</sup> Transmigrated canines may remain impacted and asymptomatic or they can cause pressure resorption of roots of adjacent teeth, pain and discomfort, and neuralgic symptoms to the patient. With the advent of panoramic radiographs, the transmigrated canines are more frequently detected than before.<sup>[5,6]</sup> Other methods such as lateral cephalograms, computed tomography (CT), and cone beam computed tomography (CBCT) can be used to accurately localize the impacted canines and to detect root resorption of the adjacent teeth.<sup>[7-9]</sup> Early diagnosis with timely orthodontic or surgical intervention can help the orthodontists preserve the canines, which play an important role, in both esthetics and function, in human dentition.<sup>[10]</sup>

### INCIDENCE

Maxillary canine impaction has an incidence in the range of 0.8–2.8%.<sup>[11-14]</sup> Mandibular canine impaction incidence is reported to be 20 times lower than that for maxillary canines.<sup>[4]</sup> In general population, the incidence of mandibular

canine impaction is 0.31%.<sup>[15]</sup> Dental transmigration is almost exclusively reported in mandibular canines. The incidence for this phenomenon has been reported to be ranging from 0.8–3.6% to 0.1%.<sup>[3,16]</sup> Kara *et al.*<sup>[17]</sup> studied the prevalence of transmigration of various mandibular teeth and reported an incidence of 0.079% for mandibular canines, 0.0017% transmigrant lateral teeth and 0.0026% transmigrant premolars.

Literature was searched from the MEDLINE database for relevant articles regarding transmigration published till 30 march 2016. Additional data was obtained by searching journals and reference list as cited in Table 1. Transmigration has been described by Nodine in prehistoric skulls. Thoma was the first to describe the anomaly in living patients.<sup>[1]</sup> Joshi and Shetty<sup>[18]</sup> reported two cases of unilateral mandibular canine transmigration. Although unilateral transmigration is more common,<sup>[19-29]</sup> bilateral cases of transmigration have also been reported by many authors.<sup>[10,12,16,29-31]</sup> Peck reported transmigration in canines and second premolars.<sup>[22]</sup> The cases reported showed a higher occurrence of transmigration in women with no difference in prevalence on both the sides.<sup>[32-34]</sup>

### Address for correspondence:

Dr. Mandeep Kaur Bhullar, E-mail: mkbhullar@yahoo.co.in

### Access this article online

#### Quick Response Code:



Website: [www.jispcd.org](http://www.jispcd.org)

DOI: 10.4103/jispcd.JISPCD\_231\_16

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: [reprints@medknow.com](mailto:reprints@medknow.com)

**How to cite this article:** Bhullar MK, Aggarwal I, Verma R, Uppal AS. Mandibular canine transmigration: Report of three cases and literature review. *J Int Soc Prevent Communit Dent* 2017;7:8-14.

**Table 1: Articles included in the study along with their objectives and results**

| Authors                 | Year | Objectives  | Conclusion  |
|-------------------------|------|---|---|
| Buyukkurt <i>et al.</i> | 2007 | The aim of the present study was to investigate the patterns of transmigrant mandibular canines, the incidence and classification of transmigrant canines, and the associated pathology of these teeth.   | The use of a panoramic radiograph is imperative and recommended for discovering such rare malpositions. If the mandibular canine that has migrated across the mandible is associated with pathology, it may be removed. Otherwise, it should be kept under observation.   |
| Aktan <i>et al.</i>     | 2008 | The study was reported to present extreme cases of 4 transmigrated mandibular canine cases with special emphasis on their classification.   | Such cases are increasing day by day. It is important to diagnose them in the early stages of migration to prevent complicated situations. Various factors related to etiology are still unanswered. Therefore, the detailed mechanism of transmigration is required.   |
| Aras <i>et al.</i>      | 2008 | The objective of this study was to investigate the incidence and pattern of transmigrant maxillary canines  | The canine transmigration can occur not only in the mandible but also the maxilla. Further studies are necessary to examine this rare phenomenon to allow classification of transmigrant canines in the maxillary arch. Thus, the incidence, demographic factors, and etiology of this phenomenon can be clarified.   |
| Vuchkova J and Farah    | 2010 | This study was done to undertake a comprehensive review of the literature and to report 4 new cases of transmigrated mandibular canines, 2 of which presented with unique features.   | One case shows a vertically positioned transmigrated canine, whereas the other shows a horizontally transmigrated canine underlying an impacted canine. Furthermore, this cohort is the first to be reported in an Australian population.   |
| Traklyali <i>et al.</i> | 2010 | To report the management of a transmigrated lower right canine.   | Transmigration is a rare dental condition that can be treated successfully with a collaborative effort of several dental disciplines.   |
| Sharma and Nagpal       | 2011 | The treatment of an impacted transmigrated canine is very complicated if it is diagnosed at a later stage. A report of 4 cases of transmigration of mandibular canine and review of literature regarding the etiology and treatment was done  | Panoramic radiograph should be taken during the mixed dentition period if the mandibular canine has not erupted from more than 1 year from its normal chronological age of eruption as intraoral periapical radiograph examination will not always detect an impacted or transmigrated canine.  |
| Verma <i>et al.</i>     | 2012 | The purpose of this article was to report the management of a transmigrated mandibular canine with emphasis on saving the tooth as natural part rather than surgical removal of the transmigrated tooth.  | Early radiographic examination of a patient is important for treatment planning. Surgical repositioning is especially valuable in cases of difficult-to-treat impaction. Intraoral periapical X-ray of reimplanted tooth was advised at 6 months interval regularly to monitor the changes at the radiolucent zone.   |
| Agarwal <i>et al.</i>   | 2013 | This article describes the treatment of a prepubertal girl, aged 10 years 6 months, with a skeletal Class I, dental Class II Division 1 malocclusion, retrognathic mandible, deep overbite, proclined maxillary incisors, midline diastema, and bilateral mandibular canine impaction.  | The orthodontic treatment plan included extraction of the deciduous canine and forced eruption of the impacted canines. A modified lip bumper appliance was used both for forced eruption and to reinforce anchorage. Through the collaborative efforts of an orthodontist and an oral surgeon, excellent esthetic and functional outcome was achieved.   |
| Novak <i>et al.</i>     | 2012 | The aim of this prospective controlled study was to determine the role that the lateral cephalogram can play in the detection of palatally displaced canines (PDCs).  | Early diagnosis of PDC is essential to avoid the occurrence of final canine impaction. If three-dimensional images of a displaced canine cannot be acquired, a lateral cephalogram can be a useful tool for the early detection of PDC in the late mixed dentition. The angle between the vertical axis of the canine and the palatal plane demonstrates diagnostic value when assessing PDCs. Values for this angle smaller than 102 degrees can indicate the presence of PDC. |
| Umashree <i>et al.</i>  | 2013 | The purpose of this paper was to present the first case of an unusual reverse oblique migration of mandibular right canine crossing the jaw midline and piercing the lower border of the mandible at the level of the opposite canine, as well as to report two more cases of transmigrated mandibular canine and one case of transmigrating mandibular canine. | With early radiographic detection and timely interception with surgical and orthodontic treatment, mandibular canines which have an increased tendency towards transmigration can be guided to erupt to its ideal position in the dental arch. If transmigration is detected at a later stage, autotransplantation is a better treatment option.  |

Contd....

Table 1: Contd...

| Authors                  | Year | Objectives   | Conclusion  |
|--------------------------|------|--|---|
| Bahl <i>et al.</i>       | 2013 | One new case of aberrantly positioned right mandibular canine was presented which has undergone migration and was accidentally found on radiological examination before orthodontic treatment.   | Once diagnosed, an aberrantly positioned impacted canine requires surgical removal.   |
| Anbiaee and Akbarian     | 2013 | Intraosseous movement of an unerupted tooth across the midline of the jaw is known as dental transmigration. This infrequent event is mostly found in the mandibular canines. There are four new cases of mandibular canine transmigration presented in the study. The literature on this anomalous phenomenon is also reviewed. | Some other treatments such as transplantation or exposure and orthodontic movement may be considered in younger patients (approximately 8–9 years of age) in which the tooth has not migrated far away from its original place. Eventually, in some asymptomatic cases, it is preferred not to treat the impacted tooth, although regular clinical and radiologic follow up are advised for evaluating its location.  |
| Cannavale <i>et al.</i>  | 2013 | This article reports the treatment of a patient with a maxillary premolar-molar transposition in the permanent dentition that was successfully managed with orthodontic treatment.   | The patient was treated with extraction of the deciduous molar and surgical exposure and ligation of the premolar. Eruption was properly guided, and the correct order of the 2 teeth was restored in the arch. This challenging treatment approach is described in detail, including the mechanics used to align the ectopic premolar. Early treatment can, in many cases, prevent a molar-premolar transposition.   |
| Almuhtaseb <i>et al.</i> | 2014 | The purpose of this study was to develop a new method to localize the impacted canines from three dimensions and to investigate the root resorption of the adjacent teeth by using cone beam computed tomography (CBCT).   | Accurate and reliable localization of the impacted canines could be obtained from the novel analysis system, which offers a better surgical and orthodontic treatment for the patients with impacted canines.   |
| Gupta <i>et al.</i>      | 2015 | This article discusses the varied clinicoradiologic presentations, etiology, and treatment options of transmigration. It also emphasizes the importance of panoramic radiographs for evaluation of over-retained deciduous canines or missing permanent canines.   | The prescription of orthopantomogram as a routine radiograph and for evaluation of over-retained deciduous canines or missing permanent canines has led to increased detection of cases of transmigration. Nine more cases have been added to the literature showing diverse clinical and radiographic presentations.   |
| Kanavakis <i>et al.</i>  | 2015 | The objective of this study was to explore differences in crown-to-root angulation between lateral incisors adjacent to palatally impacted canines (PICs) and lateral incisors adjacent to normally erupted canines (NECs).  | The root of lateral incisors adjacent to PICs is angulated more mesially compared to lateral incisors adjacent to NECs. In addition, clinicians are somewhat able to predict if a canine is palatally impacted by visually observing the crown-to-root angulation of the adjacent lateral incisor. Evaluating the crown-to-root angulation of a lateral incisor on a panoramic image might facilitate an early diagnosis of palatally impacted canines.               |
| Elhag and Abdulghani     | 2015 | This report presents the first case of combined failure of eruption of multiple teeth with bilateral mandibular canine transmigration, transposition of upper canine and the first premolar, torus palatinus, and class III incisor relationship in a 33-year-old asymptomatic and nonsyndromic female patient.                  | The results showed that PFE and bilateral canine transmigration are extremely rare and even rarer when occurring together, making treatment planning and management very challenging for the dental practitioner. There is little understanding of both conditions because they are not well presented in textbooks due to few documented cases. Further documentation of these anomalies will lead to improvement and better understanding of these rare conditions. |
| Kulkarni and Lee         | 2016 | The purpose of this study was to present the case of a 14-year-old patient with an apically closed, transmigrated permanent canine that was autotransplanted into its natural position without endodontic treatment and orthodontically aligned into ideal occlusion.  | The transplanted canine maintained long-term tooth vitality, physiologic mobility, and normal masticatory function. Also discussed are the clinical considerations and rationale behind this treatment, the clinical procedure, and factors for successfully implementing this alternative approach in managing this relatively common developmental dental anomaly.  |
| Sinko <i>et al.</i>      | 2016 | This report describes a decision-making flowchart (DMFC) with surgical strategies for the management of impacted lower canines.  | TAD-assisted orthodontic treatment and autotransplantation of impacted lower canines are tooth-preserving alternatives to extraction. The developed DMFC assists the complex treatment planning of impacted and transmigrated lower canines.  |

Maxillary canine transmigration has also been reported which is even rare.<sup>[32-34]</sup> Tarsariya *et al.* reported transmigration of mandibular canines in four cases and highlighted the importance of panoramic radiographs.<sup>[35]</sup> Gupta *et al.* reported cases showing varied clinicoradiological presentations of transmigrated canines.<sup>[36]</sup> Díaz-Sánchez *et al.*<sup>[37]</sup> and Anbiaee and Akbarian<sup>[38]</sup> reported cases of unilateral and bilateral transmigrated canines. Idris Elhag and Idris Abdulghani reported a case of failure of eruption of multiple teeth with bilateral transmigration of mandibular canines.<sup>[39]</sup> Other similar cases of transmigration of canines have been reported with varied manifestations.<sup>[40-46]</sup> This anomaly is most often asymptomatic and generally not recognized during routine intraoral clinical examination.<sup>[47]</sup> Radiographic examination such as panoramic radiographs are essential for the detection of transmigrations.

### ETIOLOGY

Various theories describing the etiology of the process of transmigration have been proposed.<sup>[48]</sup> Displacement of the dental lamina to an abnormal position in early life may result in abnormal eruptive path. Distant migration is possible in the developmental stage of the tooth apex due to rich blood circulation and active alveolar bone formation. In addition to these, other factors such as conical shape of the canine, congenitally missing lateral incisors, cystic lesions of the canine, prematurely lost or over retained deciduous teeth, tooth size arch length discrepancies, and pathological conditions can result in the diversion of canine from its line of eruption.

Mupparapu classified transmigrated mandibular canines into five types:<sup>[49]</sup>

- Type 1: Canine impacted mesioangularly across the midline, labial, or lingual to the anterior teeth with crown portion of tooth crossing the midline.
- Type 2: Canine horizontally impacted near the inferior border of the mandible below the apices of the incisors.
- Type 3: Canine erupted either mesial or distal to the opposite canine.
- Type 4: Canine horizontally impacted near the inferior border of the mandible below the apices of the premolar or molar on the opposite side.
- Type 5: Canine positioned vertically in the middle with the long axis of the tooth crossing the midline.

The incidence of these types varies with Type 1 (45.6%) being the most common, followed by Type 2 (20%), Type 4 (17%), Type 3 (14%), and Type 5 (1.5%).

### TREATMENT PLANNING

The treatment options for unerupted transmigrated mandibular canines vary depending upon their location and biological conditions.<sup>[50]</sup> They may involve surgical, orthodontic, and cosmetic dental treatment.<sup>[1,51]</sup>

### SURGICAL REMOVAL

Surgical extraction of the transmigrated teeth may be required if it is not possible to bring the tooth into alignment.<sup>[40]</sup> This is especially recommended if the mandibular arch is crowded and requires therapeutic extractions. Watted *et al.*<sup>[52]</sup> and Mesquita and Salgado<sup>[53]</sup> reported cases wherein surgical removal of

transmigrated lower canine followed by space closure was recommended. Surgical extraction of transmigrated canines has been described as an option when the prognosis of such teeth is not good.<sup>[54]</sup>

### TRANSPLANTATION

If the mandibular incisors are in a normal position and space for the transmigrated canine is sufficient, transplantation may be undertaken. Kulkarni and Lee<sup>[55]</sup> and Verma<sup>[56]</sup> reported cases of transmigrated mandibular canine managed with transplantation.

### EXPOSURE AND ORTHODONTIC ALIGNMENT

It may be possible to surgically expose and align the teeth in the dental arch when they are vertically aligned, as in the Type 5 cases, if the treatment planning dictates it. Watted *et al.*<sup>[52]</sup> reported a case with mesioangular transmigration of 43 with odontoma in the region of 83. Treatment involved surgical removal of the odontoma followed by orthodontic alignment of 43 in the arch.

### OBSERVATION

An unerupted impacted tooth may be removed as soon as convenient. However, if the tooth is symptomless, it can be left in place. In these patients, a series of successive radiographs should be obtained periodically.

Sinko *et al.*<sup>[57]</sup> described a decision-making flowchart with surgical strategies for the management of impacted lower canines depending on some key aspects such as associated pathology, patient age, compliance, and root tip position.

### CASE REPORTS

#### CASE 1

A 16-year-old male patient presented to the outpatient department (OPD) with a chief complaint of irregularly placed upper front teeth. Intraoral examination showed all the permanent teeth till 2<sup>nd</sup> molars erupted in the oral cavity except 33 (lower left permanent canine) and retained 73 (lower left deciduous canine). Both upper and lower arches were crowded with discordant faciomandibular midline and discordant maxillomandibular midlines. Molar relation on both the right and left side was end on, and there was increased overjet and overbite. Orthopantomogram of the patient showed Type 1 transmigration of impacted 33 [Figure 1]. Patient was informed about the condition and advised fixed orthodontic treatment. Treatment plan included orthodontic extractions of 14 and 24 in the upper arch and removal of the transmigrated canine and 73 in the lower arch to achieve the basic objectives of alignment and the correction of overjet, overbite, and molar relation.

#### CASE 2

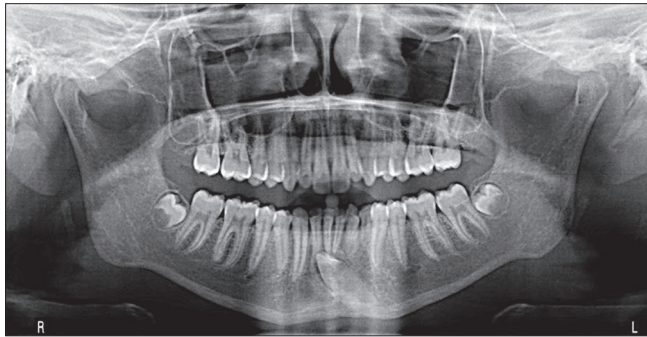
A 19-year-old female patient presented to the OPD with a chief complaint of irregularly placed upper and lower front teeth. Intraoral examination showed retained 53 and 83 and missing 13 and 43. Faciomaxillary and faciomandibular and maxillomandibular midlines were discordant. Molar relationship on both sides was Class II with increased overjet



and ovebite. Orthopantomogram of the patient showed impacted 13 and Type 2 transmigration of 43 [Figure 2]. Patient was informed about the condition and advised fixed orthodontic treatment. The treatment plan included the removal of the transmigrated canine and 83 in the lower arch and removal of 53 in the upper arch. It was planned to surgically expose 13 and bring it into alignment orthodontically. The case can be reviewed after this stage.

### CASE 3

A 17-year-old male patient presented to the OPD with a chief complaint of irregularly placed upper and lower front teeth. Intraoral examination showed retained 71, 81, and 83 and missing 22, 31, 41, and 43. Faciomaxillary and faciomandibular and maxillomandibular midlines were discordant. Molar relationship on both sides was Class I with increased overbite. Orthopantomogram of the patient showed missing 31 and 41 and Type 5 transmigration of 43 [Figure 3].



**Figure 1:** Case 1: OPG showing type 1 transmigration of the canine



**Figure 2:** Case 2: OPG showing type 2 transmigrated canine



**Figure 3:** Case 3: OPG showing type 5 transmigrated canine

Patient was informed about the condition and advised fixed orthodontic treatment. The treatment plan was to start with nonextraction fixed orthodontic treatment to achieve levelling and alignment in the upper arch followed by creating space for the replacement of 22. In the lower arch, extraction of 71 and 81 was planned followed by the eruption of 43 in place of 71 and 81 facilitated by orthodontic treatment. This can be followed by reshaping of 43.

### CONCLUSION

Canines are considered to be the cornerstones of the dental arch.<sup>[58]</sup> They play an essential role in maintaining the facial harmony and functional efficiency. The unerupted or transmigratory canines are generally asymptomatic. Radiographic examination is essential to diagnose impacted canines and panoramic radiographs are generally required to diagnose transmigrated canines.<sup>[59]</sup> Timely detection and treatment can help to preserve these canines, surrounding tissues and dentition, resulting in better esthetic and function.

### FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

### CONFLICTS OF INTEREST

There are no conflicts of interest.

### REFERENCES

1. Camilleri S, Scerri E. Transmission of mandibular canines- A review of the literature and a report of five cases. *Angle Orthod* 2003;73:753-62.
2. Tarsitano JJ, Wooten JW, Burditt JT. Transmigration of non-erupted mandibular canines: Report of cases. *J Am Dent Assoc* 1971;82:1395-7.
3. Javid B. Transmigration of impacted mandibular cuspids. *Int J Oral Surg* 1985;14:547-9.
4. Rohrer A. Displaced and impacted canines. *Int J Orthodont Oral Surg* 1929;15:1002-4.
5. Kanavakis G, Curran KM, Wiseman KC, Barone NP, Finkelman MD, Srinivasan S, *et al.* Evaluation of crown-root angulation of lateral incisors adjacent to palatally impacted canines. *Prog Orthod* 2015;16:4.
6. Cannavale R, Matarese G, Isola G, Grassia V, Perillo L. Early treatment of an ectopic premolar to prevent molar-premolar transposition. *Am J Orthod Dentofacial Orthop* 2013;143:559-69.
7. Ericson S, Kuroi PJ. Resorption of incisors after ectopic eruption of maxillary canines: A CT study. *Angle Orthod* 2000;70:415-23.
8. Almuhtaseb E, Mao J, Mahony D, Bader R, Zhang Z. Three-dimensional localization of impacted canines and root resorption assessment using cone beam computed tomography. *J Huazhong Univ Sci Technol Med Sci* 2014;34:425-30.
9. Novak HM, Baccetti T, Sigler LM, McNamara JA Jr. A controlled study on diagnostic and prognostic measurements of palatally displaced canines on lateral cephalograms. *Prog Orthod* 2012;13:42-8.
10. Auluck A, Nagpal A, Setty S, Pai KM, Sunny J. Transmigration of impacted mandibular canines- Report of four cases. *J Can Dent Assoc* 2006;72:249-52.
11. Dachi SF, Howell FV. A survey of 3,874 routine full-mouth radiographs. A study of impacted teeth. *Oral Surg Oral Med Oral Pathol* 1961;14:1165-9.

12. Kramer RM, Williams AC. The incidence of impacted teeth. A survey at Harlem hospital. *Oral Surg Oral Med Oral Pathol* 1970;29:237-41.
13. Grover PS, Lorton L. The incidence of unerupted permanent teeth and related clinical cases. *Oral Surg Oral Med Oral Pathol* 1985;59:420-5.
14. Shapira Y, Kuftinec MM. Early diagnosis and interception of potential maxillary canine impaction. *J Am Dent Assoc* 1998;129:1450-4.
15. Alaejos-Algarra C, Berini-Ayres L, Gay-Escoda C. Transmigration of mandibular canines: Report of six cases and review of the literature. *Quintessence Int* 1998;29:395-8.
16. Joshi MR. Transmigrant mandibular canines: A record of 28 cases and a retrospective review of the literature. *Angle Orthod* 2001;71:12-22.
17. Kara MI, Ay S, Aktan AM, Sener I, Bereket C, Ezirganli S, *et al.* Analysis of different type of transmigrant mandibular teeth. *Med Oral Patol Oral Cir Bucal* 2011;16:e335-40.
18. Joshi MR, Shetty SB. Transmigration of mandibular canines: A review of literature and report of two cases. *Quintessence Int* 1994;25:291-4.
19. Greenberg SN, Orlian AI. Ectopic movement of an unerupted mandibular canine. *J Am Dent Assoc* 1976;93:125-8.
20. O'Carroll MK. Transmigration of the mandibular right canine with development of odontoma in its place. *Oral Surg Oral Med Oral Pathol* 1984;57:349.
21. Broadway RT. A misplaced mandibular permanent canine. *Br Dent J* 1987;163:357-8.
22. Peck S. On the phenomenon of intraosseous migration of non-erupting teeth. *Am J Orthod Dentofacial Orthop* 1998;113:515-7.
23. Rebellato J, Schabel B. Treatment of a patient with an impacted transmigrant mandibular canine and a palatally impacted maxillary canine. *Angle Orthod* 2003;73:328-36.
24. Shapira Y, Kuftinec MM. Intrabony migration of impacted teeth. *Angle Orthod* 2003;73:738-43.
25. Buyukkurt MC, Aras MH, Caglaroglu M, Gungormus M. Transmigrant mandibular canines. *J Oral Maxillofac Surg* 2007;65:2025-9.
26. Sumer P, Sumer M, Ozden B, Otan F. Transmigration of mandibular canines: A report of six cases and a review of the literature. *J Contemp Dent Pract* 2007;8:104-10.
27. Aktan AM, Kara S, Akgunlu F, Isman E, Malkoc S. Unusual cases of the transmigrated mandibular canines: Report of 4 cases. *Eur J Dent* 2008;2:122-6.
28. Ando S, Aizawa K, Nakashima T, Sanka Y, Shimbo K, Kiyokawa K. Transmigration process of impacted mandibular cuspid. *J Nihon Univ Sch Dent* 1964;6:66-71.
29. Joshi MR, Daruwala NR, Ahuja HC. Bilateral transmigration of mandibular canines. *Br J Orthodont* 1982;9:57-8.
30. Kuftinec MM, Shapira Y, Nahlieli O. A case report. Bilateral transmigration of impacted mandibular canines. *J Am Dent Assoc* 1995;126:1022-4.
31. Al Waheidi EM. Transmigration of unerupted mandibular canines: A literature review and a report of five cases. *Quintessence Int* 1996;27:27-31.
32. Shapira Y, Kuftinec MM. Unusual intraosseous transmigration of palatally impacted canine. *Am J Orthod Dentofacial Orthop* 2005;127:360-3.
33. Aydin U, Yilmaz HH. Transmigration of impacted canines. *Dentomaxillofac Radiol* 2003;32:198-200.
34. Aras MH, Buyukkurt MC, Yolcu U, Ertas U, Dayi E. Transmigrant maxillary canines. *Oral Surg Oral Med Oral Pathol Endod* 2008;105:48-52.
35. Tarsariya VM, Jayam C, Parmar YS, Bandlapalli A. Unusual intrabony transmigration of mandibular canine: Case series (report of 4 cases) *BMJ Case Rep* 2015;2015.
36. Gupta I, Chaudhry A, Keluskar V, Mathur H. Varied clinico-radiological presentations of transmigrated canines. *J Indian Orthod Soc* 2015;49:42-5.
37. Díaz-Sánchez RM, Castillo-de-Oyagüe R, Serrera-Figallo MÁ, Hita-Iglesias P, Gutiérrez-Pérez JL, Torres-Lagares D. Transmigration of mandibular cuspids: Review of published reports and description of nine new cases. *Br J Oral Maxillofac Surg* 2016;54:241-7.
38. Anbiaee N, Akbarian G. Transmigration of Impacted Mandibular Canines: A Report of Four Cases. *J Dent Mater Tech* 2013;2:67-72.
39. Idris Elhag SB, Idris Abdulghani AS. Primary failure of eruption combined with bilateral transmigration of mandibular canines, transposition, torus palatinus, and class III incisor relationship: A rare case report. *Eur J Dent* 2015;9:594-8.
40. Bahl R, Singla J, Gupta M, Malhotra A. Aberrantly placed impacted mandibular canine. *Contemp Clin Dent* 2013;4:217-9.
41. Kumar S, Urala AS, Kamath AT, Jayaswal P, Valiathan A. Unusual intraosseous transmigration of impacted tooth. *Imaging Sci Dent* 2012;42:47-54.
42. Devadoss P, Neelakandan RS, Bhargava D, Ramakrishnan T. Bilateral transmigration of mandibular canines: A rare occurrence. *J Maxillofac Oral Surg*. 2012;11:495-7.
43. Trakyalı G, Cildir SK, Sandalli N. Orthodontic treatment of a transmigrated mandibular canine: A case report. *Aust Orthod J* 2010;26:195-200.
44. Sharma G, Nagpal A. Transmigration of mandibular canine: Report of four cases and review of literature. *Case Rep Dent* 2011;2011:381382.
45. Gruszka K, Różyło TK, Różyło-Kalinowska I, Denkiewicz K, and Masłowska K. Transmigration of mandibular canine – case report. *Pol J Radiol* 2014;79:20-3.
46. Vuchkova J, Farah CS. Canine transmigration: Comprehensive literature review and report of 4 new Australian cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;109:e46-53.
47. Al-Anezi SA. Orthodontic Management of an Impacted Mandibular Canine in a 14 Years Old Kuwaiti Girl. *J Dent Sci* 2016;4:39-42.
48. Agarwal S, Yadav S, Shah NV, Valiathan A, Uribe F, Nanda R. Correction of bilateral impacted mandibular canines with a lip bumper for anchorage reinforcement. *Am J Orthod Dentofacial Orthop* 2013;143:393-403.
49. Mupparapu M. Patterns of intraosseous transmigration and ectopic eruption of mandibular canines: Review of literature and report of nine additional cases. *Dentomaxillofac Radiol* 2002;31:355-60.
50. Narsapur SA, Choudhari S, Totad S. Unusual transmigration of canines – Report of two cases in a family. *RSBO* 2014;11:88-92.
51. Shapira Y, Kuftinec MM. Intraosseous transmigration of mandibular canines-review of literature and treatment options. *Compend Conin Educ Dent* 1995;16:1014-8.
52. Watted N, Hussein E, Awadi O, Abu-Hussein M. Transmigration of Impacted Canines: A Report of Two Cases and a Review of the Literature. *J Dent Sci* 2014;12:23-32.
53. Mesquita P, Salgado H. Transmigrant mandibular canine – Case Report. *Rev Port Estomatol Med Dent Cir Maxilofac* 2015;56:63-7.

54. Wertz RA. Treatment of transmigrated mandibular canines. *Am J Orthod Dentofacial Orthop* 1994;106:419-27.
55. Kulkarni G, Lee L. Vital Autotransplantation and Orthodontic Treatment of a Transmigrant Mandibular Canine. *Pediatr Dent* 2016;38:E1-4.
56. Verma SL, Sharma VP, and Singh GP. Management of a transmigrated mandibular canine. *J Orthod Sci* 2012;1:23-8.
57. Sinko K, Nemeč S, Seemann R, Eder-Czembirek C. Clinical Management of Impacted and Transmigrated Lower Canines. *J Oral Maxillofac Surg* 2016;74:2142e1-16.
58. Umashree N, Kumar A, Nagaraj T. Transmigration of mandibular canines. *Case Rep Dent* 2013;2013:697671.
59. Costello JP, Worth JC, Jones AG. Transmigration of permanent mandibular canines. *Br Dent J* 1996;181:212-3.