Orthodontic management of buccally erupted ectopic canine with two case reports

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Abstract

Ectopic canine teeth develop displaced from their normal position. Any permanent tooth can be ectopic, and the cause may be both genetic and environmental. Orthodontic treatment is justified because ectopic canine teeth can migrate in the jaw bone and may damage the adjacent teeth roots and bone. Orthodontic treatment is also justifiable for aesthetic reasons. Diagnosis and treatment of ectopically erupting permanent maxillary canines requires timely management by the orthodontist. Internal or external root resorption of teeth adjacent to the ectopic canine is the most common sequel. Malocclusion with severe crowding is difficult to treat without extraction. Non-extraction treatment of ectopic canines can compromise the patient’s profile. This article represents two cases of extraction treatment approach for buccally displaced or ectopic canine in a patient with severe crowding in the mandibular arch.

Keywords: Ectopic eruption, maxillary canines, orthodontic treatment

Introduction

Ectopic buccally erupted maxillary canines are one of the most frequently encountered conditions in orthodontic practice. The prevalence of permanent maxillary canine impaction or ectopic eruption in the general population is approximately 1–2%. Palatally displaced canines (PDC) occur twice as frequently as buccally. However, buccally displaced canines (BDC) are commonly seen in practice. When dentitions with PDC, erupted and unerupted, are compared with dentitions with BDC, erupted and unerupted, the main difference between these two conditions is an altered tooth size–arch length relationship.

Ectopic canines are believed to occur with a wide variety of systemic and local etiologies [Table 1]. No single etiology has been shown to explain the occurrence of a majority of ectopic eruptions or to allow differential explanation of those occurring either labially or palatally. Environmental factors may contribute to this anomaly during the long, tortuous eruption path of a canine. Another possible explanation is that a disturbance associated with the follicle of the unerupted tooth may influence the direction of eruption and contribute to the displacement of the maxillary canine.

Canine impactions are found to occur in families, suggesting a genetic or familial pattern of inheritance. Peck and Peck suggested a multi-factorial genetic pattern of inheritance for the anomaly. Specific etiologies include a lack of space, early loss of a primary canine, ankylosis, neoplastic formation, root dilacerations, and an abnormal lateral root position in relation to an erupting canine. Canine ectopia has also been associated with a genetic component. This explains a recurring occurrence in some families. Since the normal eruption path of the permanent canine is slightly buccal to the line of the arch, reduced space in the canine area together with the close proximity of the adjacent teeth will prevent the canine from taking up its normal position in the arch and it will remain buccally displaced.

Buccally ectopic canine eruption occasionally occurs in spite of adequate space in the dental arch. This condition has been defined as “primary tooth germ displacement,” meaning that the tooth develops in an aberrant site or with an unusual orientation, presumably due to an abnormal genetic pattern. No specific dental features of the dentition have been associated with these canines. Langberg and Peck found significant reductions in mesio-distal (M-D) measurements of the maxillary and mandibular incisors of subjects with PDC.

Diagnosis of permanent canine eruption irregularities begins with clinical observations of the patient. The first sign of ectopic eruption is seeing unerupted permanent canines when a patient’s dental development appears average relative to the chronologic age. The following must be considered...
during clinical evaluation of the patient: (1) the amount of space in the arch for the un-erupted/erupted ectopic canine, (2) the morphology and position of the adjacent teeth, (3) the contours of the bone, (4) the mobility of teeth, and (5) the radiographic assessment to determine the position of the canine; its apex, crown, and direction of longitudinal axis.\textsuperscript{[14]}

**Case 1**

**Diagnosis and etiology**
A 17-year-old adolescent north Indian female presented with the chief complaint of the buccally erupted ectopic maxillary canine. The patient had a routine dental history. The patient presented a symmetrical face and a convex profile. When smiling, the patient showed 90\% display of maxillary incisors and 0.5 mm of gingiva [Figure 1]. Intraoral examination revealed a Class II molar and canine relationship on the right side and Class I molar and canine relationship on the left side, 2-mm overjet and 80\% overbite. The maxillary midline deviated to the right 3 mm and the maxillary arch exhibited severe arch crowding. The mandibular arch also showed severe crowding [Figure 2]. The maxillary right canine had erupted ectopically in the arch with minimal attached tissue. The mandibular left lateral incisor had chipped off incisal edge. Cast analysis showed length discrepancy of 9 mm in the maxillary arch and 14 mm in the mandible. The panoramic radiograph showed no pathologies. The maxillary and mandibular third molars were developing [Figure 3]. The lateral cephalometric analysis revealed the patient had a skeletal Class II relationship (ANB: 3.5°, Wits: 3 mm) with a normodivergent growth pattern (SN-MP: 33°). The patient’s maxillary incisors were upright (\text{U1-SN}: 88°) and the mandibular incisors were slightly proclined (\text{IMPA}: 96°) [Figure 4].

**Treatment objectives**
The treatment objectives were to correct the ectopic position of the maxillary canine, correct the maxillary midline discrepancy, establish a Class I molar and canine relationship, relieve the crowding on both arches, obtain a normal overjet and overbite, and improve the patient’s profile.

**Treatment plan**
On the basis of diagnostic records, a treatment plan to correct the ectopic position of the maxillary canine through extraction was selected. The rationale was to avoid compromising the patient’s profile and for a more stable
treatment result. Developing maxillary and mandibular third molars will be monitored.

Treatment alternatives
Several treatment options have been suggested to correct maxillary ectopic canines. Extraction treatment of the maxillary first premolars and the mandibular first premolars with maximum anchorage on the maxillary and mandibular arch to correct the canine relationship and crowding in the mandibular arch was one option. Another option was distalizing the maxillary molars and premolars of the right side to create space for accommodation of the canine and extracting the mandibular first premolars to correct the crowding with maximum anchorage. However, non-extraction treatment involves a longer treatment time to correct and would increase the chance of adversely affecting the patient’s profile by proclining the incisors. Non-extraction treatment also increases the chance of enamel demineralization due to the extended amount of time in appliances. Extraction treatment gives more stable result because arch form is maintained.

Treatment progress
The patient was originally referred to a general dentist for evaluation of caries and hypocalcification. She was also referred to a periodontist to evaluate the amount of attached gingival tissue on her maxillary right canine.

Full-fixed 0.022-in edgewise appliances were placed on both arches; maxillary and mandibular first premolars were extracted. Segmental “T” loops of TMA wire (0.017 × 0.025) were inserted, ligating the ectopic maxillary and mandibular canine for retraction. After 6 months of treatment, a significant amount of retraction of canines had been made. A 0.014-in nickel-titanium archwire was engaged in the maxillary and mandibular arch. Two weeks later, the patient presented with a broken mandibular left lateral incisor bracket. The mandibular left lateral incisor bracket was re-bonded and a 0.012-in nickel-titanium archwire was engaged. After 6 months of treatment, a significant amount of progress had been made in aligning the maxillary and mandibular arch to accommodate the ectopic canine. Alignment of the canine and mandibular arch greatly improved as the wire progressed from 0.014-in to a 0.017 x 0.025-in nickel-titanium. The patient and parents were ecstatic about the treatment progress. Torque on the maxillary right canine was corrected a few months later by progressing in the maxilla to a 0.019 x 0.025-in stainless steel arch wire. No additional torque on the maxillary right canine was corrected a few months later by progressing in the maxilla to a 0.019 x 0.025-in stainless steel arch wire. No additional torque

Treatment results
Post-treatment records revealed that treatment objectives were achieved. Facial photographs showed an improved profile [Figures 5]. Class I canine relationships were established with canine-protected occlusion. Crowding of maxillary and mandibular arch was corrected. Dental midlines were aligned with the facial midline, and ideal overbite and overjet were achieved [Figure 6].

Case 2

Diagnosis and etiology
The patient, a 15-year-old girl, came to the Orthodontic Clinic with the chief concern of ectopic maxillary canine. Clinically, she had a straight facial profile [Figure 7]. Intraorally, the maxillary right canine and mandibular left canine had erupted ectopically out of the arch. Crowding was noted on the dental casts and panoramic radiograph. Intraoral examination revealed a Class I molar relationship. The maxillary midline deviated to the right 4 mm and the maxillary arch exhibited severe arch crowding. The mandibular arch also showed severe crowding [Figure 8]. Cast analysis showed length discrepancy of 11 mm in the maxillary arch and 12 mm in the mandible. The cephalometric radiograph and tracing showed a skeletal Class I malocclusion (ANB-2), and a normal mandibular plane angle (FMA, 23°). The maxillary incisors were proclined (U1 to FH, 109°), and the mandibular incisors were retroclined (IMP, 86°) [Figures 9 and 10]. There was no family history of this kind of malocclusion.

Treatment plan
After examining the diagnostic records, it was decided for extraction of upper and lower first premolars, aligning and leveling of anteriors, retraction of anteriors, and correction of canine relation. The rationale was to avoid compromising the patient’s profile and for a more stable treatment result. Developing maxillary and mandibular third molars will be monitored.

Treatment progress
Fixed preadjusted edgewise brackets with 0.022-in slots were placed on all teeth in both arches, with bands on the maxillary and mandibular first molars. After extraction of the maxillary and mandibular first molars, Segmental “T” loops of TMA wire (.017 × 0.025) were inserted, ligating the ectopic maxillary and mandibular canine for retraction. After 6 months of treatment, a significant amount of retraction of the canines had been made. For leveling and alignment of the maxillary and mandibular arches, a round, 0.014-in nickel-titanium archwire was engaged in the maxillary and mandibular arch. Three weeks later, a 0.016-in nickel-titanium archwire was engaged. After 6 months of treatment, a significant amount of progress had been made in aligning the maxillary and mandibular arch to accommodate the ectopic canine. Alignment of the canine...
and maxillary and mandibular dentition greatly improved as the wire progressed from 0.016-in to a 0.017 x 0.025-in nickel-titanium. Torque on the maxillary and mandibular canine was corrected 6 months later by progressing to a 0.019 x 0.025-in stainless steel archwire. After the labially placed canines were corrected and a good occlusal relationship was attained, detailing and finishing were undertaken. Patient compliance in using the elastics for settling was excellent. Total treatment time was 15 months. On the day of de-bonding, a maxillary Hawley retainer was delivered, and a mandibular canine-to-canine retainer was bonded.

Treatment results
The post-treatment extraoral photographs show general improvement in the facial profile [Figure 11]. Post-treatment intraoral photographs and dental casts show satisfactory dental alignment, Class I canine relationship on both sides,
Discussion

Maxillary canines that are potentially impacted or ectopically erupting may be inadvertently overlooked in the mixed dentition patient. This is due to individual variations in eruption patterns and timing. Periodic panoramic and selective periapical radiographs along with a careful clinical examination that includes intraoral palpation permits early diagnosis of unerupted, ectopic, and potentially impacted permanent canines. When such a diagnosis is apparent, timely interceptive therapy may then be instituted.

The amount of space in the dental arch for an unerupted canine can be assessed by performing a space analysis with a full set of orthodontic records. Space for the unerupted canine can be gained by expansion of the maxillary arch, proclination of maxillary incisors, or extraction of the permanent premolars. During palpation of the intraoral structures, the operator should also evaluate the mobility of all the teeth present. Mobile deciduous canines may indicate normal resorption of the roots by the permanent successor. However, mobility of the permanent lateral incisor may indicate potential root resorption by the impacted canine.

If the eruption pattern of the permanent canines appears to be destined for impaction or ectopic eruption, most authors agree that the primary canine should be extracted.[17-22] This in fact has been shown to be effective in up to 91% when the permanent canine is located distal to the long axis of the lateral incisor, yet only 64% effective when the canine overlaps medially to the long axis midline of the lateral incisor.[23]

In the above case reports adequate results were achieved through an extraction treatment approach. If the four premolars were not extracted, it might have resulted in proclination of the maxillary and mandibular anterior teeth with a harmful result to the patient’s soft tissue profile. By extraction treatment approach, it is much easy to correct the crowding and achieve more stable results.

Crowding is found in a minority of PDC cases, and most of the palatally impacted canines occur when excess space is available in the dental arch.[24-26] In contrast, buccal displacement of the maxillary canines has been strongly associated with crowding.[24,27] Jacoby[24] reported that only 17% of BDC subjects presented sufficient space for eruption in the arch. Oliver et al. found that BDC were more frequent in Orientals who also displayed more crowding, whereas PDC was more frequent among Caucasians.[28]

Becker et al.[29] reported reductions in bucco-lingual and M-D tooth sizes of males with PDC, compared with male controls, whereas the teeth of females were similar in size to the female controls. Tooth size and dental arch dimensions are determining factors in dental crowding, but no reported attempts have so far been made to study the specific reason
for the dentoalveolar disproportion (lack of space) found in the majority of subjects with BDC.

The BDC and PDC diagnosis was made on the basis of a clinical examination and diagnostic radiographs, according to established standardized techniques.[30,31] In those cases where the canines were initially unerupted and surgical exposure was required as an integral part of their treatment, this was always performed in the presence of the orthodontist, for objective treatment reasons, and included visual confirmation of the radiographic diagnosis.

**Conclusion**

The successful treatment of a patient with an ectopic tooth and severe crowding can be a challenging task for an orthodontist. Proper treatment of an ectopic canine patient with severe crowding requires careful treatment planning by the orthodontist. The decision to extract the premolars is to be good aesthetically, functionally, and for more stable results in these patients. In light of the attention currently being paid to aesthetics as a primary treatment goal for both practitioner and patient, today’s treatment plans for patients with ectopic canine must consider more than the orthodontic outcome.

**References**

1. Bedoya MM, Park JH. A review of diagnosis and management of impacted maxillary canines. J Amnt Assoc 2009;140:1485-93.
2. Fleming P, Scott P, Heidari N, Dibiase A. Influence of radiographic position of ectopic canines on the duration of orthodontic treatment. Angle Orthod 2009;79:442-6.
3. Cooke J, Wang HL. Canine impactions: Incidence and management. Int J Periodontics Restorative Dent 2006;26:483-91.
4. Fearne J, Lee RT. Favorable spontaneous eruption of severely displaced maxillary canines with associated follicular disturbance. Br J Orthod 1988;115:93-8.
5. Peck S, Peck L. The palatally displaced canine as a dental anomaly of genetic origin. Angle Orthod 1990;12:135-9.
6. Ngan P, Hornbrook R, Weaver B. Early timely management of ectopically erupting maxillary canines. Semin Orthod 2005;11:152-63.
7. Bishara SE. Impacted maxillary canines: A review. Am J Orthod 1992;101:1-16.
8. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod 1988;10:283-95.
9. Jacoby H. The etiology of maxillary canine impaction. Am J Orthod 1982;84:125-89.
10. Basdra EK, Kiokpasoglou MN, Komposch G. Congenital tooth anomalies and malocclusions: A genetic link? Eur J Orthod 2001;23:145-51.
11. Bacetti T. A controlled study of associated dental anomalies. Angle Orthod 1998;68:267-74.
12. Becker A. The orthodontic treatment of impacted teeth. London: Martin Dunitz Publishers; 1998.
13. Langberg BJ, Peck S. Tooth-size reduction associated with occurrence of palatal displacement of canines. Angle Orthod 2000;70:126-8.
14. Moss JP. The unerupted canine. Dent Pract 1972;22:241-8.
15. Chadwick BL, Roy J, Knox J, Treasure ET. The effect of topical fluorides on decalcification in patients with fixed orthodontic appliances: A systematic review. Am J Orthod 2005;128:601-6.
16. Zimmer BW, Rottwinkel Y. Assessing patient-specific decalcification risk in fixed orthodontic treatment and its impact on prophylactic procedures. Am J Orthod 2004;126:318-24.
17. Leivesley WD. Minimizing the problem of impacted and ectopic canines. ASDC J Dent Child 1984;51:367-70.
18. Bishara SE. Impacted maxillary canines: A review. Am J Orthod Dentofacial Orthod 1992;101:159-71.
19. Williams BH. Diagnosis and prevention of maxillary cuspid impaction. Angle Orthod 1981;51:130-40.
20. Ngan P, Wolf T, Kassoy G. Early diagnosis and prevention of impaction of the maxillary canine. ASDC J Dent Child 1987;54:335-8.
21. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. Eur J Orthod 1988;10:283-95.
22. Kuftinec MM, Shapira Y. The impacted maxillary canine: I. Review of concepts. ASDC J Dent Child 1995;62:317-24.
23. Vermette ME, Kokich VG, Kennedy DB. Uncovering labially impacted teeth: Apically positioned flap and closed-eruption techniques. Angle Orthod 1995;65:23-32.
24. Jacoby H. The etiology of maxillary canine impaction. Am J Orthod 1983;84:125-32.
25. Zilberman Y, Cohen B, Becker A. Familial trends in palatal canines, anomalous lateral incisors and related phenomena. Eur J Orthod 1990;12:135-9.
26. Peck S, Peck L, Kataja M. Prevalence of tooth agenesis and pegshaped maxillary lateral incisor associated with palatally displaced canine (PDC) anomaly. Am J Orthod Dentofacial Orthop 1996;110:441-3.
27. Becker A. Etiology of maxillary canine impactions. Am J Orthod 1984;65:437-8.
28. Oliver RG, Mannion JE, Robinson JM. Morphology of the lateral incisor in cases of unilateral impaction of the canine. Br J Orthod 1989;19:9-16.
29. Becker A, Sharabi S, Chaushu S. Tooth size variation in dentitions affected by palatal canine displacement. Eur J Orthod 2002;24:313-8.
30. Seward GR. Radiology in general dental practice. IX-unerupted impacted teeth: Apically positioned flap and closed-eruption techniques. Angle Orthod 1995;65:23-32.
31. Hunter SB. The radiographic assessment of the unerupted maxillary canine. Br J Orthod 1981;150:151-5.