Management of the palatally ectopic maxillary canine

Dr Jamil Husain
Professor Donald Burden
Dr Patrick McSherry

Introduction

The maxillary canine is second only to the mandibular third molar in its frequency of impaction with a prevalence of about 1.5%. Ectopic canines occur palatally with twice the frequency that they do buccally.[1] General dental practitioners and orthodontists will commonly encounter this problem and need to be fully aware of managing this situation. Failure to diagnose and manage the ectopic upper canine efficiently can result in more complex remedial treatment becoming necessary, which would be costly in terms of clinical time for both the practitioner and patient. There is also the risk of damage occurring to adjacent teeth, which may lead to costly litigation claims.

The aetiology of the palatal canine ectopia remains unclear but is likely to be polygenic[2] and multifactorial.[3] There is evidence that palatally ectopic canines occur more frequently than expected among family members. There may also be an association[4] with absent, malformed or diminutive lateral incisors,[5] an absence of crowding and late developing dentitions.[6] The majority of canines undergoing normal eruption should be palpable in the buccal sulcus by 10 to 11 years.[7] Those maxillary canines erupting after approximately 12.3 years in girls and 13.1 years in boys may be considered late.[8]

Sequelae of canine ectopia

The main risk from ectopia appears to be root resorption of adjacent teeth, usually the incisors. It has been estimated that 0.6–0.8% of children in the 10–13-year age group have permanent incisors resorbed as a result of canine ectopia.[1] However, cone-beam computed tomography scanning has detected root resorption in 66.7% of permanent lateral incisors adjacent to ectopic maxillary canines.[9] It has been stated that root resorption of incisors by palatally ectopic canines rarely starts after 14 years of age[10] and it occurs most frequently between 11 and 12 years.[11]

Other possible sequelae of canine ectopia are resorption of the coronal aspect of the root, which is most likely to occur in adults, with quoted frequencies of up to 14%[12] and cystic changes, the frequency of which is generally thought to be low.[13]

DIAGNOSIS AND MANAGEMENT

1. History and Examination

Practitioners should suspect ectopia if the canine is not palpable in the buccal sulcus by the age of 10–11 years, if palpation indicates an asymmetrical eruption pattern or the position of adjacent teeth implies a malposition of the permanent canine. The patient with an ectopic maxillary canine must undergo a comprehensive assessment of the malocclusion, including accurate localisation of the canine.

1.1 Radiographic examination[14–16]

Radiographic procedures prior to the age of 10–11 years are usually of little benefit in terms of the knowledge gained.[1,7] The examination usually involves taking two radiographs and using the principle of horizontal or vertical[17] parallax. Recent research has shown that the horizontal parallax technique is more reliable than vertical parallax in localising unerupted canines.[18]

HORIZONTAL PARALLAX

1. Anterior occlusal and periapical
or
2. Two periapicals

VERTICAL PARALLAX

1. Anterior occlusal (70–75°) and optical projection tomography (OPT)
or
2. Periapical and OPT

More recently, cone beam computed tomography technology has become available for imaging the maxillofacial region and this can be used for the localisation of impacted teeth, including canines.[9] This technique allows highly accurate localisation of the impacted tooth and visualisation of associated structures. However, it is associated with a higher overall effective dose than conventional radiography and currently there are no formal referral criteria with regard to its use in the UK and its routine use is not considered justified in Orthodontics.[14]

2. Treatment

Radiographic examination should be carried out initially to confirm the position of the unerupted canine. Patient and parent counselling on the various treatment options is essential.

2.1 Interceptive treatment by extraction of the deciduous canine[19–22]

In selected cases there is some evidence that interceptive extraction of a retained deciduous canine can result in an improvement in the position of an ectopic permanent canine.

> The patient should be aged between 10 and 13 years, with better results reported in the absence of crowding.

> The need to maintain space (or even create additional space) requires consideration.

> If radiographic examination reveals no improvement in the ectopic canine's position 12 months after extraction of the deciduous canine, alternative treatments should be considered.

[SIGN Grade A]

2.2 Surgical exposure[23] and orthodontic alignment

> The case is not considered to be suitable for interceptive extraction of the deciduous canine.

> The patient should be willing to wear fixed orthodontic appliances.

> The patient should be well motivated and have good dental health.

> The degree of malposition of the ectopic canine should not be so great that orthodontic alignment is impractical (eg close proximity to the midline, above the apices of the adjacent teeth, horizontal angulation).

[SIGN Grade C]

2.3 Surgical removal of the palatally ectopic permanent canine

> This treatment option should be considered if the patient declines active treatment and/or is happy with his or her dental appearance.

> Surgical removal of the ectopic canine should be considered if there is radiographic evidence of *early* root resorption of the adjacent incisor teeth (but exposure and alignment of the ectopic canine is usually indicated in cases in which *severe* root resorption of an incisor tooth has occurred, necessitating the extraction of the incisor).

> The best results are achieved if there is good contact between the lateral incisor and first premolar or if the patient is willing to undergo orthodontic treatment to substitute the first premolar for the canine.

- The possible risk of damaging the roots of adjacent teeth during the act of surgically removing the impacted canine should be assessed and discussed with the patient.

[SIGN Grade C]

2.4 Transplantation[24–27]

- Transplantation is not normally considered unless other possible active (or interceptive) treatment has failed or is felt to be inappropriate.
- This treatment option can be considered if the patient is unwilling to wear orthodontic appliances or if the degree of malposition is too great for orthodontic alignment to be practical.
- There should be adequate space available for the canine and sufficient alveolar bone to accept the transplanted tooth.
- The prognosis should be good for the canine tooth to be transplanted with no evidence of ankylosis. The best results are achieved if the ectopic canine can be removed with minimal trauma.
- Depending on the stage of root formation (more than 3/4 of the root formed) the transplanted canine may require root canal therapy to be commenced within ten days following transplantation.

[SIGN Grade B]

2.5 No active treatment/leave and observe

- The patient does not want treatment or is happy with his or her dental appearance.
- There should be no evidence of root resorption of adjacent teeth or other pathology.
- Ideally there should be good contact between the lateral incisor and first premolar or the deciduous canine should have a good prognosis.
- Severely displaced palatally ectopic canines with no evidence of pathology may be left in situ, particularly if the canine is remote from the dentition. If the ectopic canine is left in situ, then as with any unerupted tooth, the practitioner providing continuing care for the patient should carry out a careful clinical examination of the patient on a regular basis to ensure the unerupted canine does not represent a risk to the patient's wellbeing. No guidance currently exists as to how frequently radiographic checks should be carried out.

[SIGN Grade C]

EXPLANATORY NOTES

Treatment planning for patients with palatally ectopic maxillary canines is not straightforward due to the large number of patient factors and orthodontic considerations that must be taken into account. It is strongly recommended that less experienced practitioners seek the opinion of an orthodontic specialist prior to initiating any of the above treatment options.

Section 2.1

Clinical inspection and buccal palpation of the alveolus in the canine region are recommended annually from the age of eight years. Initial research appeared to indicate that the interceptive isolated extraction of the associated deciduous canine, if successful, was a very cost-effective and simple method of correcting canine ectopia.[19] This original study found that 78% of palatally ectopic canines reverted to a normal path of eruption following the extraction of the primary canine, although success appeared to reduce as the degree of malposition increased. A later investigation appeared to confirm this finding although the success rate was found to be slightly lower (62%).[20]

Subsequently, in a longitudinal prospective study of this interceptive technique,[21] it was found that successful permanent canine eruption occurred in 36% of cases in the untreated control group but in 65.2% of cases that

had had isolated extraction of the deciduous canine and this was statistically significant; interestingly, when (cervical pull) headgear was used, along with extraction of the deciduous canine, the success rate increased to 87.5%.

A recent systematic review found that no clinical trials currently available adequately met the inclusion criteria required for the review and as a result it was concluded that there was currently no scientifically robust evidence to support the extraction of the deciduous maxillary canine to facilitate the eruption of the permanent successor.[22] Further well-reported randomised controlled trials are required to assess the full effectiveness of this clinical intervention.

Section 2.2

Much of the evidence supporting surgical exposure and orthodontic alignment as a treatment approach is derived from case studies. However, clinical experience has shown that surgical exposure and orthodontic alignment of a palatally ectopic canine can be a highly successful treatment approach. As with all orthodontic treatment the cooperation and motivation of the patient is paramount. The general dental health should be good since the treatment time is often prolonged. When comparing open versus closed exposure techniques, some authors[28] consider that the available evidence favours the latter approach, while others have reported that there is no evidence to show that subsequent periodontal health is better with either one, although repeat surgery is more common with the closed exposure technique.[23] Currently there is no clear evidence to support one surgical technique over the other in terms of dental health, aesthetics, economics and patient factors.[29] However, it is generally agreed that the optimal time for surgical exposure and orthodontic alignment is during adolescence.[30–32]

Section 2.3

Surgical removal of the ectopic canine is most often considered when dental aesthetics are acceptable with good contact between the lateral incisor and the first premolar. It is also considered when the canine is severely malpositioned, when alignment and transplantation are not being considered and in cases in which there are pathological changes and/or its retention would impede orthodontic tooth movement. If necessary, fixed orthodontic appliances can be used to bring the first premolar forward to simulate a canine tooth: mesio-palatal rotation of the premolar, placement of buccal root torque and/or grinding of the palatal cusp can also help to improve aesthetics. Clinical experience would indicate that there is a large variation in the life expectancy of retained deciduous canines.

Section 2.4

Transplantation is sometimes considered for grossly displaced ectopic maxillary canines or when prolonged orthodontic treatment is unacceptable to the patient. Early studies revealed disappointing long-term results when this approach was adopted, with a high frequency of root resorption occurring. More recent studies using a meticulous atraumatic surgical technique and stabilisation of the transplanted tooth with a sectional archwire for six weeks have reported better results.[27] However, the long-term (> 5 years) prognosis of transplanted palatally ectopic canines has yet to be evaluated, although for other teeth it can be as high as 90%.[25,26]

Acknowledgements

We would like to acknowledge, with grateful thanks, the suggestions and assistance of Dr David Morris and the clinical standards committee of the British Orthodontic Society, particularly Dr Martyn Cobourne, in producing the final version of this updated guideline.

Further reading

McSherry, PF. The ectopic maxillary canine: a review. *Br J Orthod* 1998; **25:** 209–16.

References

1. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. *Am J*

Orthod Dentofacial Orthop 1987; **91:** 483–92.
2. Peck S, Peck L, Kataja M. The palatally displaced canine as a dental anomaly of genetic origin. *Angle Orthod* 1994; **64:** 249–56.
3. Peck S, Peck L, Kataja M. Concomitant occurrence of canine malposition and tooth agenesis: evidence of orofacial genetic fields. *Am J Orthod Dentofacial Orthop* 2002; **122:** 657–60.
4. Zilberman Y, Cohen, Becker A. Familial trends in palatal canines, anomalous lateral incisors, and related phenomena. *Eur J Orthod* 1990; **12:** 135–39.
5. Brin I, Becker A, Shalhav M. Position of the maxillary permanent canine in relation to anomalous or missing lateral incisors: a population study. *Eur J Orthod* 1986; **8:** 12–16.
6. Chaushu S, Sharabi S, Becker A. Dental morphologic characteristics of normal versus delayed developing dentitions with palatally displaced canines. *Am J Orthod Dentofacial Orthop* 2002; **121:** 339–46.
7. Ericson S, Kurol J. Longitudinal study and analysis of clinical supervision of maxillary canine eruption. *Community Dent Oral Epidemiol* 1986; **14:** 172–76.
8. Hurme VO. Ranges of normalcy in the eruption of permanent teeth. *J Dent Child* 1949; **16:** 11–15.
9. Walker L, Enciso R, Mah J. Three-dimensional localization of maxillary canines with cone-beam computed tomography. *Am J Orthod Dentofacial Orthop* 2005; **128:** 418–23.
10. Houston WJB, Stephens CD, Tulley WJ. *A Textbook of Orthodontics*, 2nd edn. Bristol: Wright; 1992. p187.
11. Ericson S, Kurol J. Resorption of maxillary lateral incisors caused by ectopic eruption of the canines. A clinical and radiographic analysis of predisposing factors. *Am J Orthod Dentofacial Orthop* 1988; **94:** 503–13.
12. Azaz B, Shteyer A. Resorption of the crown in impacted maxillary canine. A clinical, radiographic and histologic study. *Int J Oral Surg* 1978; **7:** 167–71.
13. Mourshed F. A roentogenographic study of dentigerous cysts. I. Incidence in a populaton sample. *Oral Surg Oral Med Oral Pathol* 1964; **18:** 47–53.
14. Isaacson KG, Thom AR, Horner K, Whaites E. *Orthodontic Radiographs – Guidelines*, 3rd edn. London: British Orthodontic Society, 2008.
15. Mason C, Papadakou P, Roberts GJ. The radiographic localization of impacted maxillary canines: a comparison of methods. *Eur J Orthod* 2001; **23:** 25–34.
16. Jacobs, SG. Localisation of the unerupted maxillary canine: How to and when to. *Am J Orthod Dentofacial Orthop* 1999; **115:** 314–22.
17. Southall PJ, Gravely JF. Vertical parallax radiology to localize an object in the anterior part of the maxilla. *Brit J Orthod* 1989; **16:** 79–83.
18. Armstrong C, Johnston C, Burden D, Stevenson M. Localizing ectopic maxillary canines – horizontal or vertical parallax? *Eur J Orthod* 2003; **25:** 585–89.
19. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. *Eur J Orthod* 1988; **10:** 283–95.
20. Power SM, Short MBE. An investigation into the response of palatally displaced canines to the removal of deciduous canines and an assessment of factors contributing to favourable eruption. *Br J Orthod* 1993; **20:** 215–23.
21. Baccetti T, Leonardi M, Armi P. A randomized clinical study of two interceptive approaches to palatally displaced canines. *Eur J Orthod* 2008; **30:** 381–85.
22. Parkin N, Benson PE, Shah A et al. Extraction of primary (baby) teeth for unerupted palatally displaced permanent canine teeth in children. *Cochrane Database of Syst Rev* 2009; **2:** CD004621.
23. Burden DJ, Mullally BH, Robinson SN. Palatally ectopic canines: Closed eruption versus open eruption. *Am J Orthod Dentofacial Orthop* 1999; **115:** 640–44.
24. Thomas S, Turner SR, Sandy JR. Autotransplantation of teeth: Is there a role? *Br J Orthod* 1998; **25:** 275–82.
25. Czochrowska EM, Stenvik A, Bjercke B, Zachrisson BU. Outcome of tooth transplantation: survival and success rates 17-41 years posttreatment. *Am J Orthod Dentofacial Orthop* 2002; **121:** 110–19.

26. Andreasen JO, Paulsen HU, Yu Z, Ahlquist R, Bayer T, Schwartz O. A long-term study of 370 autotransplanted premolars, parts I–IV. *Eur J Orthod* 1990; **12:** 3–50.
27. Sagne S, Thilander B. Transalveolar transplantation of maxillary canines. A critical evaluation of a clinical procedure. *Acta Odontol Scandin* 1997; **55:** 1–8.
28. Becker A. *The Orthodontic Treatment of Impacted Teeth*. Oxford: Informa Healthcare; 2007.
29. Parkin N, Benson PE, Thind B, Shah A. Open versus closed surgical exposure of canine teeth that are displaced in the roof of the mouth. *Cochrane Database of Syst Rev* 2008; **4:** CD006966.
30. Galloway I, Stirrups DR. The effect of age at diagnosis on the complexity and outcome of treatment of palatally ectopic canines. *Br J Orthod* 1989; **16:** 259–63.
31. Altonen M, Myllarniemi S. Results of surgical exposure of impacted cuspids and bicuspids in relation to patients' somatic and dental maturation. *Int J Oral Surg* 1976; **5:** 180–86.
32. Stewart JA, Heo G, Glover KE et al. Factors that relate to treatment duration for patients with palatally impacted maxillary canines. *Am J Orthod Dentofacial Orthop* 2001; **119:** 216–25.