

Innovations

Impaction of Upper Cuspid – A Review

Mothi Krishna MDS (Senior lecturer),

Vijayadhith MDS (HOD),

Ashok pothuri MDS (Reader),

Lingesh kumar MDS (Senior lecturer),

Mohana krishnan MDS (Senior lecturer).

Priyadarshini Dental College and Hospital.

Abstract

Maxillary canine impactions are frequently encountered in orthodontic practice, with the maxillary permanent canines being the second most commonly impacted teeth after third molars. Several factors contribute to impaction, including genetic predisposition, insufficient space in the dental arch, abnormal eruption paths, and the presence of other dental anomalies. Early diagnosis and intervention are crucial to mitigate potential complications, such as malocclusion, root resorption, and soft tissue problems. Diagnostic tools like panoramic radiographs, cone-beam computed tomography (CBCT), and clinical examination aid in precise localization, classification, and assessment of the impacted canines. Early diagnosis and intervention are crucial to mitigate potential complications, such as malocclusion, root resorption, and soft tissue problem. Management of canine impaction typically involves an interdisciplinary approach, with orthodontists, oral surgeons, and general dentists working collaboratively. Treatment options may include surgical exposure and orthodontic traction, guided eruption, or extraction with orthodontic space closure, depending on the specific case and patient age. This abstract provides a concise overview of the key aspects related to maxillary canine impactions, encompassing their prevalence, etiology, diagnosis, treatment planning, and management options.

Key words: *Palatally, labially, early diagnosis, localisation*

Introduction

Maxillary canine impaction is a common dental anomaly that occurs when one or both of the permanent maxillary canine teeth, also known as "fangs" or "eye teeth," fail to erupt into their proper positions within the dental arch. These teeth are essential for both oral function and aesthetics, serving as integral components of a person's smile and bite and also in canine guided occlusion. The term impaction was derived from the Latin word 'impactus' which means pushed against. Impacted teeth are those which has failed to erupt completely or partially to their correct position in the dental arch and their eruption potential has been lost¹. In simple terms, an impacted tooth is when the root is fully formed but hasn't emerged into its normal position in the mouth. Understanding the differences between impacted, submerged and unerupted teeth is important in the context of treating maxillary canine impactions.

Maxillary canines, generally have their $\frac{3}{4}$ root completed by 11-12 years of age². The precise aetiology of canine impactions is multifactorial, involving a combination of genetic predisposition, inadequate space in the dental arch, irregular eruption paths, and sometimes, the presence of other dental anomalies. Understanding the underlying causes and recognizing the signs of canine impaction is crucial for early diagnosis and effective management^{2,3}. In this discussion, we will explore the complexities surrounding canine impaction, including its prevalence, causative factors, classification, diagnostic methods, and various treatment modalities. By gaining insights into this condition, dental professionals can provide timely intervention and personalized treatment plans, ultimately helping individuals achieve proper dental function, aesthetics, and overall oral health²⁻⁵.

Incidence

- Maxillary canine – second most commonly impacted after third molars.
- Population-Caucasians⁵.
- Gender-Females more common.
- Upper jaw – Left side more common.
- Palatal vs Labial – Palatal more common.
- Bilateral retention seen in 14% cases.
- Crown position - 47.9% in slanting position, 33% in slanting position, 19% in sagittal plane^{5,6}.

Etiology

The exact aetiology of palatally impacted maxillary cuspids is unknown; however, two common theories may explain the phenomenon: the guidance theory and the genetic theory⁴. The "guidance theory of palatal canine displacement" suggests that this anomaly results from various local factors such as congenitally missing lateral incisors, supernumerary teeth, odontomas, tooth transposition, and other mechanical elements, all of which impede the normal eruption path of the canine. Maxillary canines develop high in the maxilla and are among the last teeth to develop and travel a long path before they erupt into the dental arch. These factors increase the potential for mechanical disturbances resulting in displacement and, thus, impaction. The second theory claims that the impacted cuspids have a hereditary basis. Palatally impacted maxillary cuspids often present with other dental abnormalities, including tooth size, shape, number and structure, which Baccetti reported to be linked genetically. It is believed that a number of anomalies, which appear as a developmental disruption during embryonic growth, possess a common genetic cause. Research demonstrates that up to 33% of patients with palatally impacted cuspids also have congenitally missing, a frequency that is 4-9 times that of the general population. Studies also show that up to 47.7% of patients with palatally impacted cuspids have small, peg-shaped or missing lateral incisors. Palatally impacted canines occur simultaneously 2.4 times more frequently in patients with congenitally missing maxillary lateral incisors than in the general population. Maxillary canines impacted in the palatal region are also linked to anomalies like enamel hypoplasia, primary molars with infra-occlusion, and aplastic second bicuspid. However, it remains uncertain whether the anomalous lateral incisor is a local causal factor for palatally displaced canines or an associated genetic developmental influence^{5,7,8}. According to Vonder Heydet's concept, the canine tooth is both larger and typically erupts later, similar to a musical chair situation, which may increase the likelihood of impaction⁸.

Diagnosis

Visual inspection

Clinical signs that may indicate ectopic or impacted succedaneous cuspids include lack of a canine bulge in the buccal sulcus by the age of 10 years, over-retained primary cuspids, delayed eruption of their permanent successor and asymmetry in the exfoliation and eruption of the right and left canines⁴. The retention of primary cuspids beyond the age of 13 years, coupled with their lack of significant mobility, strongly suggests the displacement and impaction of permanent canines. The position of lateral incisors also describes the canine position. Retroclined lateral incisors can also result from buccally directed forces, which make the root tilt toward the lip side (labially) and the crown tilt toward the palate side

(palatally). In severe cases, the central incisor may also be affected, and its crown may become malpositioned⁴⁻¹⁰.

Palpation

Canines can be felt about 1 to 1.5 years before they emerge. The absence of the canine bulge after the age of 10 years is a strong indicator that the tooth is displaced from its normal position, and there is a possibility of ectopic eruption or impaction of the maxillary cuspids⁴⁻¹².

Radiograph

Radiographs are indicated when canine bulges are not present; right and left canine development and eruption are asymmetrical. The most commonly used radiographic method is the tube shift method or the parallax technique introduced by Clark in 1910¹³. Occlusal radiographs provide more precise information about the exact positions of the canines with respect to the midline than periapical films provide for transverse position diagnosis. The anterior-posterior position, inclination, and vertical location of the displaced tooth within the alveolus can all be evaluated with the assistance of lateral cephalometric radiographs. Although conventional dental radiographs provide satisfactory diagnostic images, they lack the accuracy necessary for assessing palatal or buccal root resorption of the lateral incisor especially with mild or early resorption^{13,14,15}. When it comes to 3-dimensional cuspid location and the diagnosis of related lesions such as adjacent tooth root resorption, computed tomography (CT) provides more accuracy. CBCT is superior to conventional radiographs for detecting and visualizing the positions and complications of maxillary impacted canines. Spiral CT is better in the case of elderly patients¹⁶.

Rapid prototyping

Rapid prototyping is a new method for diagnosis and treatment planning of maxillary canine impactions by using computed tomography combined with rapid prototyping. A model developed using this method showed the exact anatomical relationship between the impacted teeth and the other teeth; it was the main aid in intraoperative navigation during surgery to expose the teeth¹⁷.

Diagnostic methods for assessment of prognosis:

Conventional methods:

Sector method

Modified sector method

Angular method^{18,19}

McSherry and Pitt's method²⁰

CBCT:

KPG index and modified KPG index method²¹.

Sequelae of impacted canine:

Labial or lingual malpositioning of impacted teeth, migration of neighbouring teeth resulting in the loss of arch length, internal or external resorption of impacted or neighbouring teeth, formation of dentigerous cysts, and the potential for infection, especially in cases of partial eruption, which can lead to referred pain^{22,23,24}

When to extract the impacted canine

Here are the reasons for not attempting orthodontic treatment

1. If the canine is ankylosed and cannot be transplanted.
2. When the canine is undergoing external or internal root resorption.
3. In cases where the canine's root displays severe dilaceration.
4. When the impaction is severe, for example, if the canine is trapped between the roots of the central and lateral incisors, and orthodontic treatment poses a risk to these neighbouring teeth.

5. If the current bite alignment is satisfactory, with the first premolar occupying the canine's position and an overall functional bite with well-aligned teeth.
6. When there are pathological changes present, such as cyst formation or infection.
7. If the patient does not wish to undergo orthodontic treatment.

Interceptive treatment

Extraction as a preventive measure is based on the idea that retaining the deciduous tooth could obstruct the emergence of the permanent tooth. Some experts, including Broadbent, Lappin, Newcomb, and others, have recommended selective extraction of deciduous canines as early as 8 or 9 years old. Ericson and Kurol have suggested that removing the deciduous canine before the age of 11 can help correct the position of ectopically placed permanent canines. The success rate is approximately 91% when the permanent canine crown is positioned distal to the midline of the lateral incisor. However, it drops to 64% if the permanent canine crown is mesial to the midline of the lateral incisor. Baccetti and colleagues have concluded that using a rapid maxillary expander as an early interceptive approach is effective in increasing the rate of eruption for palatally displaced canines. Other methods of creating space include by utilising existing incisor space and improving arch length and arch form^{4,8,23,24}.

Management of impacted maxillary canine

Surgical intervention without orthodontic treatment. *Fournier et al (1982)* suggest that labially impacted with a favourable vertical positioned tooth may be treated initially by surgical exposure but without the application of a traction force. He believes that in younger patients the tooth will erupt on its own after surgical exposure, whereas in older patients' traction is almost always indicated. He considers that whereas traction is generally recommended for older patients, the tooth will spontaneously erupt in younger patients following surgical exposure^{25,26}.

Surgical techniques for exposing impacted canines

1. Window approach/circular incision/(gingivectomy).
2. Apically repositioned flap (ARF).
3. Closed flap eruption technique (FCET).
4. Tunnel traction (TT)²⁷.
5. Piezoelectric surgery
6. VISTA technique²⁸

Attachments

Cast caps, Orthodontic bands, Orthodontic brackets, Simple eyelet, U-Flex attachment, Titanium Button with Chain, Magnets. Non-bondables such as Lasso wire and threaded pins. Non-bondables are indicated where there is severe moisture contamination and in cases where the labial aspect of the crown cannot be exposed but not advised nowadays²⁹.

Connectors

They maintain the contact with the attachment before it is bonded to the tooth. Various attachments such as Ligature wire, gold chain, and Elastic thread can be used²⁹.

Treatment alternatives

No treatment is pursued if the patient does not wish for it. However, it's important to note that the long-term outlook for the deciduous canine is unfavorable, as its root may eventually undergo resorption. Therefore, periodic evaluations are necessary. Another option is auto transplantation of the canine.

Alternatively, the impacted canine can be extracted, and the premolar can be repositioned in its place. In some cases, the canine can be extracted, and a posterior segmental osteotomy can be performed to move the buccal segment mesially to close the remaining gap. The most desirable approach is surgical exposure of the canine followed by orthodontic treatment and Prosthetic replacement^{22,29}.

Complications

Lack of movement occurs because of not enough bone removed around the crown, in appropriate orthodontic mechanics, the tooth is found to be ankylosed during surgery, and improper bonding where bonding is done on bone rather than canine^{22,29,30,31}.

Prognosis

The duration of treatment ranges from 18-26 months with an average of 26 months. The success rate for placement of canines on the dental arch was 76.5% and the sector method associated with the angulation method on the OPG could help the orthodontist to assess the prognosis of impacted canines. In addition to this periodontal health should also be monitored to assess the prognosis. To minimize or prevent rotational relapse, a fiberotomy or a bonded fixed retainer may need to be considered after the completion of the desired movements and sometimes before the appliances are removed^{29,30}.

Conclusion

Maxillary canine teeth play an important role in esthetics and function, especially in canine-guided occlusion. Early diagnosis and detection of a potentially impacted maxillary canine and timely interceptive removal of the primary canine reduce the need for complicated orthodontic treatment. Our understanding of the aetiology of impacted maxillary canines is limited. Much work needs to be done to try to clarify and classify different etiological factors associated with canine impaction. Additional research may help us prevent, or more effectively treat, the complexities of canine-eruption disturbances. We recommend that all general dentists, orthodontists, and oral surgeons treat impacted teeth conservatively. Teeth that might have been thought to be impossible to salvage might be saved with this approach.

References

1. Varghese, G. (2021). *Management of Impacted Third Molars*. In: Bonanthaya, K., Panneerselvam, E., Manuel, S., Kumar, V.V., Rai, A. (eds) *Oral and Maxillofacial Surgery for the Clinician*. Springer, Singapore.
2. Power SM, Short MB. 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 Aug;20(3) 215-223.
3. GRON AM. Prediction of tooth emergence. *J Dent Res*. 1962 May-Jun;41:573-85.
4. Richardson G, Russell KA. A review of impacted permanent maxillary cuspids-diagnosis and prevention. *J Can Dent Assoc*. 2000 Oct;66(9):497-501. PMID: 11070629.
5. Cooke J, Wang HL. Canine impactions: incidence and management. *Int J Periodontics Restorative Dent*. 2006 Oct;26(5):483-91. PMID: 17073358.
6. Ake Nordenram, Christian Stromberg, *Positional variations of the impacted upper canine: A clinical and radiologic study*, *Oral Surgery, Oral Medicine, Oral Pathology*,
7. Jacoby H. *The aetiology of maxillary canine impactions*. *Am J Orthod*. 1983 Aug;84(2):125-32.

8. *Litsas G, Acar A. A review of early displaced maxillary canines: etiology, diagnosis and interceptive treatment. Open Dent J. 2011 Mar 16;5:39-47.*
9. *von der Heydt K. The surgical uncovering and orthodontic positioning of unerupted maxillary canines. Am J Orthod. 1975 Sep;68(3):256-76.*
10. *Gensior AM, Strauss RE. The direct bonding technique is applied to the management of the maxillary-impacted canine. J Am Dent Assoc. 1974 Dec;89(6):1332-7.*
11. *Bishara SE, Kommer DD, McNeil MH, Montagano LN, Oesterle LJ, Youngquist HW. Management of impacted canines. Am J Orthod. 1976 Apr;69(4):371-87*
12. *Jacobs SG. The impacted maxillary canine. Further observations on aetiology, radiographic localization, prevention/interception of impaction, and when to suspect impaction. Aust Dent J. 1996 Oct;41(5):310-6.*
13. *Walker L, Enciso R, Mah J. Three-dimensional localization of maxillary canines with cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2005 Oct;128(4):418-23.*
14. *Sajjani, A.K. and King, N.M. (2013), Diagnosis and localization of impacted maxillary canines: comparison of methods. J Invest Clin Dent, 4: 252-256.*
15. *Mason, Carol & Papadakou, P & Roberts, Graham. (2001). The radiographic localization of impacted maxillary canines: A comparison of methods. European journal of orthodontics. 23. 25-34. 10.1093/ejo/23.1.25.*
16. *Preda L, La Fianza A, Di Maggio EM, Dore R, Schifino MR, Campani R, Segù C, Sfondrini MF. The use of spiral computed tomography in the localization of impacted maxillary canines. DentomaxillofacRadiol. 1997 Jul;26(4):236-41.*
17. *Faber J, Berto PM, Quaresma M. Rapid prototyping as a tool for diagnosis and treatment planning for maxillary canine impaction. Am J Orthod Dentofacial Orthop. 2006 Apr;129(4):583-9.*
18. *Counihan K, Al-Awadhi EA, Butler J. Guidelines for the assessment of the impacted maxillary canine. Dent Update. 2013 Nov;40(9):770-2, 775-7.*
19. *Mohammad, Ruba. (2021). Orthodontic Evaluation of Impacted Maxillary Canine by Panoramic Radiograph-A Literature Review. Journal of Research in Medical and Dental Science. 9. 220-227.*
20. *Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. Eur J Orthod. 2006 Apr;28(2):141-4.*
21. *San Martín DE, English JD, Kau CH, Gallerano RL, McGrory KR, Salas AM, Bouquot J, Xia JJ. The KPG index--a novel 3D classification system for maxillary canine impactions. Tex Dent J. 2012 Mar;129(3):265-74. PMID: 22667060; PMCID: PMC4637171.*
22. *Manne R, Gandikota C, Juvvadi SR, Rama HR, Anche S. Impacted canines: Etiology, diagnosis, and orthodontic management. J Pharm Bioallied Sci. 2012 Aug;4(Suppl 2):S234-8.*
23. *Shapira Y, Kuftinec MM. Early diagnosis and interception of potential maxillary canine impaction. J Am Dent Assoc. 1998 Oct;129(10):1450-4.*
24. *Becker A, Chaushu S. Long-term follow-up of severely resorbed maxillary incisors after resolution of an etiologically associated impacted canine. Am J Orthod Dentofacial Orthop. 2005 Jun;127(6):650-4; quiz 754.*
25. *Fournier A, Turcotte JY, Bernard C. Orthodontic considerations in the treatment of maxillary impacted canines. Am J Orthod. 1982 Mar;81(3):236-9.*
26. *Johnston WD. Treatment of palatally impacted canine teeth. Am J Orthod. 1969 Dec;56(6):589-96.*
27. *Crescini A, Clauser C, Giorgetti R, Cortellini P, Pini Prato GP. Tunnel traction of infraosseous impacted maxillary canines. A three-year periodontal follow-up. Am J Orthod Dentofacial Orthop. 1994 Jan;105(1):61-72.*
28. *Management of an impacted maxillary canine with the vertical incision subperiosteal tunnel (VISTA) technique [Internet]. Iaoi.pro. [cited 2023 Oct 15].*
29. *Management of impacted canine using different attachments and auxiliaries - A review. worldwidejournals.com global-journal-for-research-analysis June 2017.*

30. Stewart JA, Heo G, Glover KE, Williamson PC, Lam EW, Major PW. Factors that relate to treatment duration for patients with palatally impacted maxillary canines. *Am J Orthod Dentofacial Orthop.* 2001 Mar;119(3):216-25.
31. Becker A, Chaushu S. Success rate and duration of orthodontic treatment for adult patients with palatally impacted maxillary canines. *Am J Orthod Dentofacial Orthop.* 2003 Nov;124(5):509-14.