Review Article

Canine impaction: Diagnosis and management

ABSTRACT

The position of the permanent canine at the angle of the mouth is strategically significant in maintaining the harmony and symmetry of the occlusal relationship. However, the canine is the second most frequently impacted tooth, with prevalence reported to be between 1% and 2%. This article reviews the etiology and management of the ectopic canine. The management options are detailed, and the indications for each treatment modality based on the available scientific evidence are presented. Awareness of the eruption process, etiological factors of erupting canine will help to reduce the incidence of impacted canines by allowing for the early recognition and interceptive treatment.

Keywords: Canine impaction, dental, diagnosis, impacted, orthodontics, review

INTRODUCTION

An impacted maxillary canine is usually diagnosed during a routine dental examination. Disturbance in the eruption of permanent maxillary canines can cause problems in the dental arch and adjacent teeth, which require special care and attention.[1] Therefore, clinicians should be capable of dealing with this clinical situation to deliver optimal treatment.[2] Impacted teeth are the tooth which fails to erupt after the normal development pattern is complete. Canines are the most common impacted tooth, following the third molars. First evidence of canine development is at the age of 30 weeks postnatally. Calcification gets completed by 4–5 months, and normal eruption is at 11–12 years. Canines have the longest period of development and path of eruption.[3]

- Percentage
- Incidence 0.8–2.8
- Palatal: Buccal 85:15
- Bilateral: Unilateral 8:92
- F: M ratio 2.3:1
- Left: Right 5:2
- Maxilla: Mandible 8:1

NUMEROUS ETIOLOGICAL FACTORS ARE

Genetic

- Systemic: Like endocrine disorders, febrile conditions, and/or irradiation
- Local factors: Tooth size arch length discrepancies-common for labial impactions
- Failure of the primary canine resorption. Prolonged retention or early loss of the primary canine, ankylosis of the permanent canine, cyst or neoplasm, dilaceration of the root, absence of the maxillary lateral incisor-common for palatal impactions, size of the lateral incisor (peg-shaped lateral incisor), and variation in the timing of lateral incisor root formation.[4]

Namrata V. Shehare, Suchita Tarvade, Harsha J. Kaurani

Department of Orthodontics and Dentofacial Orthopaedics, C.S.M.S.S. Dental College, Aurangabad, Maharashtra, India

Address for correspondence: Dr. Namrata V. Shehare, Department of Orthodontics and Dentofacial Orthopaedics, C.S.M.S.S. Dental College, Aurangabad, Maharashtra, India.
E-mail: namrataghunawat@gmail.com

Received: 06-Feb-2021 **Revised:** 07-Jun-2021
Accepted: 13-Sep-2021 **Published:** 12-Nov-2021

Access this article online	
Website: www.orthodrehab.org	Quick Response Code
DOI: 10.4103/ijor.ijor_5_21	

How to cite this article: Shehare NV, Tarvade S, Kaurani HJ. Canine impaction: Diagnosis and management. Int J Orthod Rehabil 2021;12:126-30.

CLASSIFICATION OF CANINE IMPACTION

a. Based on the position in dental arch[2,3]
   - Class I-Palatally impacted maxillary canine: Horizontal, vertical, and angulated
   - Class II-Labially impacted canine: Horizontal, vertical, and angulated
   - Class III-Impacted canine with crown on the palatal side and root on the buccal side or vice versa
   - Class IV-Vertically impacted canine between the lateral incisor and 1st premolar
   - Class V-Canine impacted in the edentulous maxilla.

b. Ericson and Kurol in AJO 1988.[5]
   - Sector 1: If the cusp tip of the canine is between the inter incisor median line and the long axis of the central incisor
   - Sector 2: If the cusp tip of the cuspid is between the major axes of the lateral and central
   - Sector 3: If the cusp tip of the cuspid is between the major axis of the lateral and the first premolar.

c. Modification of Ericson and Kurol's classification by Lindauer[6]
   - Sector I: Located distal to a tangent to the distal crown and root of the lateral incisor
   - Sector II: The area from the tangent on the distal surface to a midline bisector of the lateral incisor tooth
   - Sector III: The area from the midline bisector to a tangent to the mesial surface of the lateral incisor crown and root
   - Sector IV: All areas mesial to sector III.

d. Field and Ackerman classification.[3]

MAXILLARY CANINE

a. Labial position [Figure 1]
   1. Crown in an intimate relationship with incisors
   2. Crown well above the apices of incisors.

b. Palatal position:
   1. Crown near the surface, in close relationship with roots of incisors
   2. Crown deeply embedded in close relationship to apices of incisors.

c. Intermediate position:
   1. Crown between lateral incisors and 1st premolar roots
   2. Crown above these teeth with crown labially placed and palatally placed or vice versa.

d. Unusual position: In nasoantral wall.

e. In infraorbital margin.

MANDIBULAR CANINE

a. Labial position: Vertical, oblique, and horizontal

b. Unusual position: At inferior border,
   - In mental protuberance,
   - Migrated to the opposite side along with the original nerve supply.

DIAGNOSIS

i. Clinical assessments

ii. Radiographic assessments.

Clinical assessments

Impacted canine teeth can be detected as early as the age of 8 years. It is done with two methods: Clinical inspection and palpation [Figure 2].[2,3]

Inspection

Clinical examination includes overall arch inspection. Mobility or the absence of primary canines past its eruption age. Persistent median diastema, abnormality or missing lateral incisor, ectopic deviation of lateral incisor from its position may all be signs of canine impaction. Clinical examination for the presence of bulge in the canine region deep in the vestibule should be done buccally as well as palatally.

Palpation

In the absence of canine, palpation by finger deep in the vestibule above the deciduous canine should be done palatally/buccally above the deciduous canine 2–3 years before its eruption. It should be palpated deep above

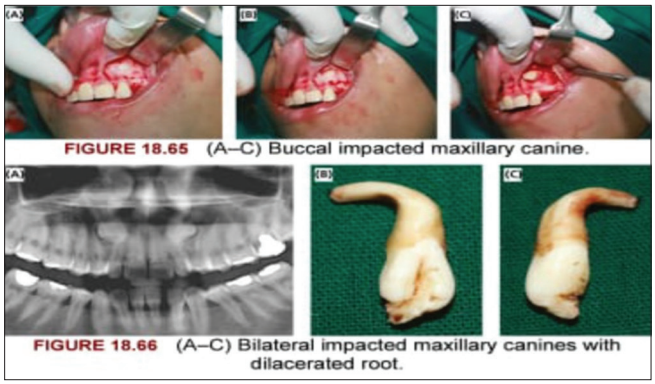

Figure 1: Position of impacted canine

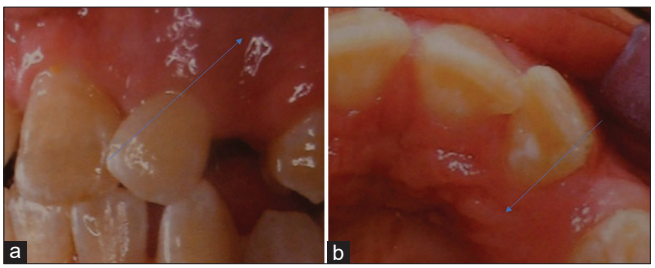

Figure 2: Diagnosis by (a) Inspection. (b) Palpation

attached gingiva in the sulcus where mucosa reflects. Deciduous canine should be checked for mobility. The presence of bulge provides a positive sign of impacted canine. However, it should be noted that the absence of bulge does not prove the absence of impacted canine.

When there is a clinical presence of any of these signs, radiographic examination should be performed to confirm the diagnosis [Figure 3].

RADIOGRAPHIC ASSESSMENTS

IOPA

The simplest and the most informative X-view passes through minimum of surrounding tissues; it gives accuracy and quality of resolution. It is aimed to be perpendicular to an imaginary plane bisecting the angle between the long axis of an erupted tooth and the film plane to produce minimum distortion. It gives information about the presence or absence of impacted tooth, stage of development, presence and size of follicle, crown or root resorption, resorption pattern and integrity, presence or absence of supernumerary tooth, and soft tissue lesions like cysts.[3]

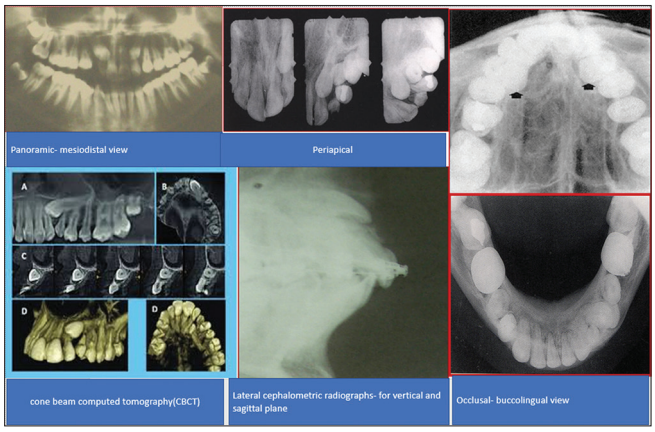

Figure 3: Different methods of radiographic assessment

Orthopantomogram

Panoramic radiographs are also widely used to locate the position of impacted canines. They are part of the fundamental ray films. As this imaging taken for dental records and treatment planning. They provide an overall look of the entire dentition, including the temporomandibular joint (TMJ). Many prediction values proposed in the literature come from this type of radiograph [Figure 3].[2,7]

Occlusal radiograph

Occlusal radiographs can identify the position of impacted maxillary canines accurately in conjunction with routine periapical radiographs. When properly obtained, they provide information about the buccolingual direction of the crown and root of the canine. They also provide information related to the distance between the midline and the position of the canines. The disadvantage of this radiograph is that it cannot provide any information about the vertical position of the canines [Figure 3].[2,3]

Lateral cephalometric radiographs

It can help determine the position of impacted canines relative to other structures. They are helpful because they are some of the fundamental radiographs that all patients have taken before the beginning of orthodontic treatment.

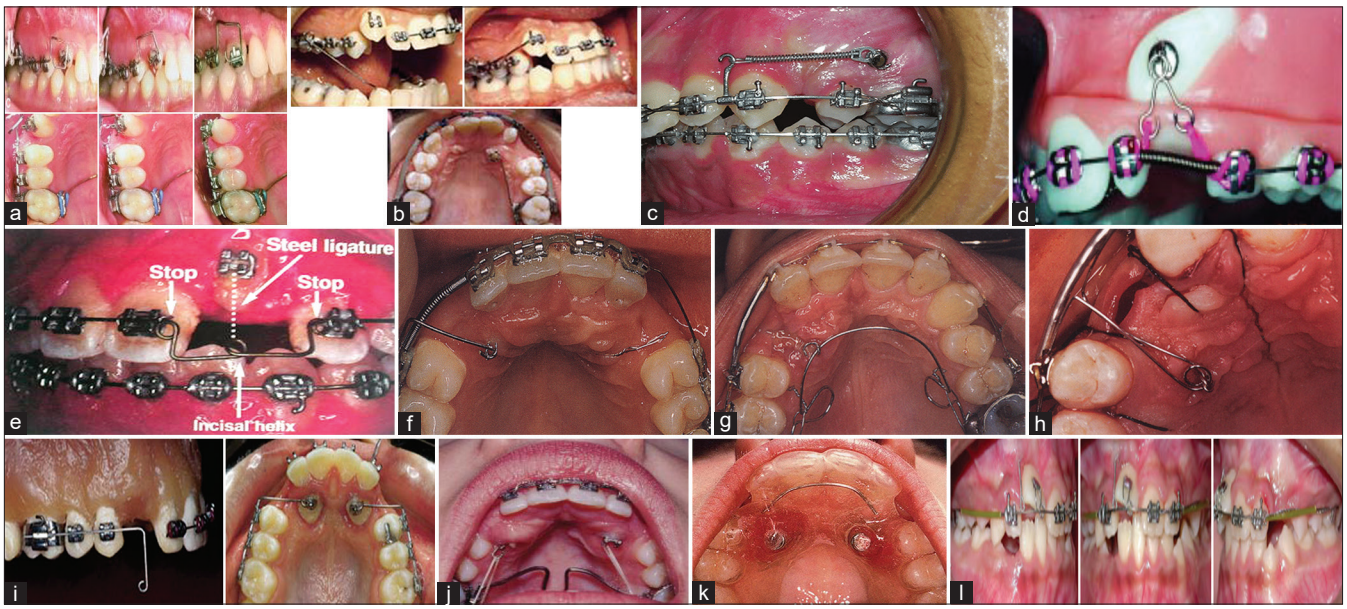

Figure 4: (a) TMA box loop. (b) Cantilevers. (c) Nickel titanium closed coil spring. (d) Monkey loop. (e) Australian helical arch wire. (f) Ballista spring. (g) Active palatal arch. (h) Light auxiliary labial arch. (i) The K-9 spring. (j) Mandibular anchorage. (k) Magnets. (l) Multi-purpose attachment

Cone-beam computed tomography scanning

Recently, the use of computed tomography (CT) scanning has been suggested (Ericson and Kurol, 1988), to identify the exact position of an impacted canine Esp. when root resorption of Lt. Incisor is suspected. In this method, clear serial radiographs may be taken at gradated depths in any part of the human body. This technique allows elimination of the superimposition of other structures, the relationship of the impacted tooth to the adjacent teeth, in all three planes of space, may be accurately assessed [Figure 3].[2,3] This method may also give accurate information regarding early root resorption particularly of the buccal and palatal surfaces, TMJ evaluations, 3-dimensional views of upper airways, assessment of maxillofacial growth, and development and dental age estimation. This may not be possible to diagnose by any other method before treatment. The major disadvantage of cone-beam CT is the increased amount of radiation exposure, which is at least 4 times higher than with ordinary panoramic radiograms and its high cost.

TREATMENT ALTERNATIVES

1. Surgical exposure followed by orthodontic alignment
2. Surgical removal followed by prosthetic rehabilitation.

Surgical exposure followed by orthodontic alignment

Of all the treatment alternatives, most desirable approach is surgical exposure of the canine followed by orthodontic treatment. It is recommended to surgically expose the crown of impacted canine after leveling and alignment of the erupted teeth. It is most useful when the canine has a correct axial inclination and does not need to be uprighted during its eruption.[2,3] It is a spontaneous but slow process. It increases treatment time. Two approaches are generally recommended in regard to the timing of placing the attachment:

a. Two-step approach
b. One-step approach.

Two-step approach

In this approach, the canine is surgically uncovered, and the area is packed with a surgical dressing to avoid the filling-in of tissues around the tooth. After wound healing, within 3–8 weeks, the pack is removed, and an attachment is placed on the impacted tooth.

One-step approach

In this approach, attachment is placed on the tooth at the time of surgical exposure. The tissues over the attachment should be excised, and periodontal pack should be given.

Attachments: [Figure 4]

a. Lasso wire: Shapira and kuftinec
b. Bands: Von der heydt
c. Cast canine caps: Lewis, Dewel

threaded pins: Becker and Zilberman

d. Direct bonding: Jacoby, Nielson
e. Elastic ties and modules
f. Magnets.

FORCE GENERATING DEVICES

1. TMA Box Loop[8] made with 0.017 × 0.025. It produces sagittal and transverse corrections while continuing vertical eruption
2. Cantilevers[9] used to move teeth labiolingually or mesiodistally. For buccally impacted canine-0.017 × 0.025 TMA and for palatally impacted 0.016 × 0.025 TMA is used
3. Nickel-titanium closed coil spring[2,10] made with 0.009 "×0.041" spring. It is used for many techniques for space closure, individual tooth retraction or protraction, distal movement of teeth, and traction on impacted teeth. Nickel-titanium coil springs do not exhibit rapid force. It provides 80 g of force when stretched to its resting length
4. Monkey loop[11] It is a simple auxiliary with an open loop on each end for attachment of intraoral elastic or elastomeric chain or for connecting to a bondable loop button
5. Australian helical arch wire[12] made with special plus 0.016" archwire

Activation is done by twisting the steel ligature wire after every 2 weeks.

6. Ballista spring[11] (Jacoby 1979): It is made of rectangular wires. It proceeds forward until it is opposite to canine space and bent vertically downward, and terminate into a small loop. With slight finger pressure, the spring is tied to pigtail ligature. By this, it provides an extrusive force for the canine to erupt
7. Active palatal arch[13] (Becker 1978): It consists of fine 0.020-inch removable palatal archwire carrying an omega loop on each side. End of the wire is double-ended for frictionless fit in lingual sheath. It is activated by elevating downward activated palatal archwire and hooking the pigtail ligature around it
8. Light auxiliary labial arch[14] (Kornhauser1996): It is made up of 0.014-inch round SS wire with vertical loops in the area of impacted canine on both sides. It has a small helix. This wire is tied with the basal arch wire in piggyback fashion. If the basal archwire is not used it will lead to extrusion of the adjacent tooth and cause alteration of the occlusal plane

9. The K-9 spring[11,15] made in 0.017" X 0.025" TMA wire. It is simple in design with low cost. No patient compliance. it serves light continuous eruptive and distalizing forces
10. Mandibular anchorage[16] lingual arch is fabricated with 0.036-inch SS wire. Vertical hooks (5-6 mm in length). Elastic force should not exceed 40–60 g
11. Magnets[16] samarium cobalt magnet coated with thermoplastic material is used. It is less traumatic and poses less risk of infection than conventional orthodontic methods
12. Multi-purpose attachment[16] a small rectangular piece of molar band material (thickness O. 180" × 0.005") is used. Its 3 edges are kept straight and the 4th is contoured. The contoured edge makes the base of the attachment. Strip of about 5-6 mm in length and 2-3 mm in width is then cut from the molar band material. The strip is then bent in the middle up to 90. One arm of the strip is then welded onto the base up to the fold. The other free arm is then bent fully and welded keeping a lumen between the two arms. A hook can be made by twisting the strands of a piece of ligature wire alter passing it through the lumen of the attachment. This attachment can be used for bonding on to a surgically exposed tooth. Even if the tooth gets covered by gingiva after some time. The hook remains out and can be used for tying ligatures or elastomeric to the main archwire to get the tooth in occlusion and alignment.

Surgical removal followed by prosthetic rehabilitation[16] factors which decides surgical removal of impacted canines?

1. If it is ankylosed and cannot be transplanted
2. If it is undergoing external or internal root resorption
3. If its root is severely dilacerated
4. If the impaction is severe (e.g., The canine is lodged between the roots of the central and lateral incisors and orthodontic movement will jeopardize these teeth)
5. If the occlusion is acceptable, with the first premolar in the position of the canine and with an otherwise functional occlusion with well-aligned teeth
6. If there are pathologic changes (e.g., Cystic formation, infection), and the patient does not desire orthodontic treatment.

SUCCESS RATE AND DURATION OF TREATMENT

The success rate among the adults was 69.5% with increase in the duration and number of treatment visits.

It was concluded that the prognosis for successful orthodontic resolution of an impacted canine worsens with age.

CONCLUSION

Canine impaction is a relatively frequent clinical presentation in dentistry, with challenges that should be resolved. The management of impacted canines is important in terms of aesthetics and function. Clinicians must formulate treatment plans that are in the best interest of the patient, and they must be knowledgeable about the variety of treatment options. Various surgical and orthodontic techniques may be used to recover impacted maxillary canines. The proper management of these teeth, however, requires that the appropriate surgical technique be used. Careful selection of surgical and orthodontic techniques is essential for the successful alignment of impacted canines.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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