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## Canine Impaction: A Review

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### Abstract

Impaction of canines is an oftenly encountered clinical issue, the treatment of which ordinarily requires an interdisciplinary approach. The orthodontic treatment of impacted maxillary canine remains a challenge to today's clinicians as it is important in terms of esthetics 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. Management includes from diagnosis to surgical exposure of the impacted tooth and the complex orthodontic mechanisms that are applied to align the tooth into the arch may lead to varying amounts of damage to the supporting structures of the tooth, not to mention the long treatment duration and the financial burden to the patient. With early detection, timely interception and well-managed surgical and orthodontic treatment, impacted maxillary canines can be allowed to erupt and be guided to an appropriate location in the dental arch. However, it is only with interdisciplinary care of general dentists and specialists that impacted maxillary canines can be treated successfully. Hence, it appears beneficial to focus on the means of early diagnosis and interception of this clinical situation. In the present article, an overview of the frequency and sequelae, as well as the surgical, periodontal, and orthodontic considerations in the management of impacted canines is presented.

**Keywords:** Diagnosis, etiology, impacted canines, orthodontic techniques, prevention, surgical techniques

### Introduction

Impaction refers to the complete or partial failure of a tooth to erupt after the normal age of tooth eruption <sup>[1]</sup>, when the length of the root reaches three-fourth of its final length <sup>[2]</sup>. Dachi and Howell <sup>[3]</sup> reported that the prevalence of maxillary canine impaction is 0.92%, whereas Thilander and Myrberg <sup>[4]</sup> estimated the incidences of canine impaction in 7-to 13-year-old children to be 2.2%. Ericson and Kuro P <sup>[5]</sup> estimated the incidence at 1.7%. Impactions are two times more common in females (1.17%) as in males (0.51%). Of all patients with maxillary impacted canines, 8% have bilateral impactions. For the mandibular canine impaction is 0.35%.

**Etiology:** Aetiology of Impacted Teeth Multiple factors are responsible for impaction, the most commonly reported etiological factors were divided into two groups in this literature <sup>[6-9]</sup>. Local causes include irregular position or pressure of adjacent teeth, greater density of overlying or surrounding bone, fibrosis of overlying mucous membrane, lack of space due to under developed jaws, over retained deciduous teeth. Prenatal or postnatal causes which can interfere with growth and development of the child such as Rickets, Anaemia, Congenital syphilis, Tuberculosis,

Endocrine dysfunction, Malnutrition, Irradiation or rare conditions Cleidocranial dysplasia, Oxycephaly, Progeria, Achondroplasia, Cleft palate. Becker *et al* <sup>[10]</sup> reported an increase of 2.4 times in the incidence of palatal impacted canines adjacent to the sites of missing lateral incisors as compared with the general population.

### Sequelae of Impaction

According to Shafer *et al* <sup>[11]</sup> consequence of impacted tooth can be

- Impacted tooth mispositioning,
- Arch length shortening due to migration of adjacent teeth
- Internal resorption,
- Root resorption of the impacted tooth, or adjacent teeth,
- Development of dentigerous cyst
- Infection,
- Pain, and
- Combinations of the above sequelae

### Diagnosis of Impaction

The diagnosis of canine impaction is based on both clinical and radiographic examinations.

**Clinical Examination:** the following might indicate impaction

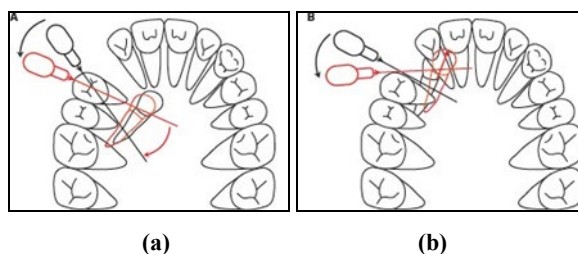
- i). Delayed eruption of the permanent canine or prolonged retention of the deciduous canine beyond 14 to 15 years of age,
- ii). Absence of a normal labial canine bulge,
- iii). Presence of a palatal bulge shown in (figure 1), and
- iv). Delayed eruption, distal tipping, or migration (splaying) of the lateral incisor. But for an accurate diagnosis the clinical examination should be supplemented with a radiographic evaluation.



**Fig 1:** Palatal bulge

**Radiographic Evaluation:** Various radiographic exposures, including occlusal films, panoramic views, and lateral cephalograms, can help in evaluating the position of the canines, in most cases periapical films are uniquely reliable for that purpose.

- i). **Periapical Film:** They are the first X-rays to be requested, are the simplest and the most informative films [12]. and are most useful to assess the vertical and anteroposterior position of the impacted tooth in the alveolus. It is the two-dimensional picture of an area of dentition. To obtain a three-dimensional visualization, two periapical films are taken of the same area, with the horizontal angulations of the cone changed (Tubeshift technique or Clark's rule or SLOB method) (Fig. 2) or vertical angulations of the cone is changed by approximately 20° (Buccal-object rule), when the second film is taken. In other words, first film would relate the impacted tooth to the neighbouring teeth both mesiodistally and superoinferiorly. A second periapical film would provide position of the impacted tooth buccolingually [13].



**Fig 2 (a, b):** Clark's method of buccolingual location of impacted object. Two IOPA X-rays are made while keeping the film in same location but X-ray tube is moved either mesially or distally. An object closer to the X-ray film, i.e. palatal will appear to move in the same direction as the X-ray beam while opposite true for a buccal object. A. Palatal impacted canine moved distally with distal movement of X-ray B. Buccal impacted canine moved mesially with distal movement of X-ray

- ii). Occlusal Films also help in visualizing the buccolingual position of the impacted tooth in conjunction with

periapical films, provide that the image of impacted canine is not superimposed on the other structure.

**iii). Extraoral Films**

- a) Frontal and lateral cephalograms can sometimes aid in the determination of the position of the impacted tooth, particularly its relationship to other facial structures (e.g., the maxillary sinus and then floor of the nose).
- b) Panoramic films are also used to localize impacted teeth in all three planes of space, much the same as with two periapical films in the tube-shift method, with the understanding that the source of radiation comes from behind the patient; thus, the movements are reversed for position. It provides a good overview of the status of dentition and eruption pattern, root formation and pattern of the roots. The modern digital OPG X-rays have good contrast and brightness with minimal magnification in the central trough. The digital images can be manipulated onscreen and careful observations can be made on zoomed images to see the relationship of the impacted tooth/teeth with roots of neighbouring teeth and the path of eruption. Ericson and Kurol in 1987 [14, 15] developed a method for predicting palatally erupting maxillary canines after deciduous canine extraction. The position of canine was determined in 3 planes, in frontal view (OPG), in the transverse plane (vertex projection), in the sagittal plane (lateral head film)
  - i). The mesial inclination of the crown of the canine to the midline ( $\alpha$  angle)
  - ii). The distance of the cusp tip of the permanent canine from the occlusal line (d).
  - iii). The medial crown position in sectors (1-5) (figure 3, 4)

- 3. Lindauer and colleagues (1992) [16] drawing on the work of Ericson and Kurol (1987) developed a method based on the location of the impacted canine cusp tip and its relationship to the adjacent lateral incisor. Dividing impacted canines into four groups-sectors I through IV, with sector IV representing the most severe impaction-they determined that as many as 78% of the canines with cusp tips in sectors II through IV were destined to become impacted.

- a) Sector I-cusp tip distal to a line tangent to the distal heights of contour of the lateral incisor crown and root.
- b) Sector II-mesial to sector I, with the cusp tip distal to a line bisecting the mesiodistal dimension of the lateral incisor along the long axis.
- c) Sector III-mesial to sector II, with the cusp tip distal to a line tangent to the mesial heights of contour of the lateral incisor crown and root.
- d) Sector IV-any position mesial to sector III. (Figure 3)



**Fig 3:** sector classification modified

4. Cone Beam Computed Tomography is a novel method, which provides the orientation of the impacted tooth in all the three planes of space along with the 3-dimensional relationships with adjacent structures. Wriedt *et al* [17] concluded that 64% of all patients, canine position was assessed concordantly in 2D and 3D images. Canine inclination visible in the panoramic X-rays was the most important factor influencing the treatment proposal. Small volume CBCT may be justified as a supplement to a routine panoramic X-ray in the following cases; when canine inclination in the panoramic X-ray exceeds 30°, when root resorption of adjacent teeth is suspected, and/or when the canine apex is not clearly discernible in the panoramic X-ray, implying dilaceration of the canine root.

### Treatment Modalities

**Interceptive Treatment:** Williams suggested that selective extraction of the deciduous canines as early as 8 or 9 years of age as an interceptive approach to canine impaction in Class I uncrowded cases. Ericson and Kuroi [12] suggested that removal of the deciduous canine before the age of 11 years will normalize the position of the ectopically erupting permanent canines in 91% of the cases if the canine crown is distal to the midline of the lateral incisor. On the other hand, the success rate is only 64% if the canine crown is mesial to the midline of the lateral incisor [12].

**Treatment Alternatives:** Each patient with an impacted canine must undergo a comprehensive evaluation of the malocclusion. The clinician should then consider the various treatment options available for the patient, including the following [3]

No treatment if the patient does not desire it. In such a case, the clinician should periodically evaluate the impacted tooth for any pathologic changes. It should be remembered that the long-term prognosis for retaining the deciduous canine is poor, regardless of its present root length and the esthetic acceptability of its crown. This is because, in most cases, the root will eventually resorb, and the deciduous canine will have to be extracted.

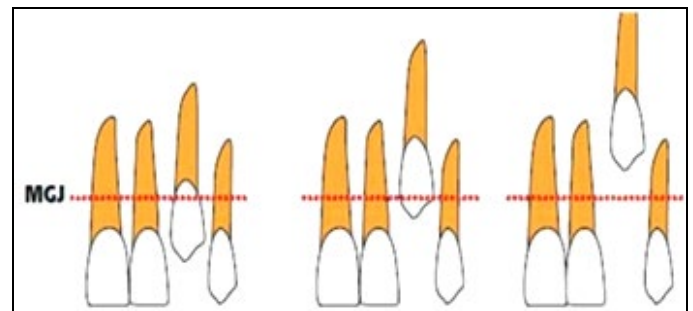
- i). Autotransplantation of the canine.
- ii). Extraction of the impacted canine and movement of a first premolar in its position.
- iii). Extraction of the canine and posterior segmental osteotomy to move the buccal segment mesially to close the residual space.
- iv). Prosthetic replacement of the canine.
- v). Surgical exposure of the canine and orthodontic treatment to bring the tooth into the line of occlusion. This is obviously the most desirable approach.

The option of extracting canine should be considered in following situations [18]

- i). If it is ankylosed and cannot be transplanted,
- ii). If it is undergoing external or internal root resorption,
- iii). If its root is severely dilacerated,
- iv). If the impaction is severe
- v). 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,
- vi). If there are pathologic changes,
- vii). If the patient does not desire orthodontic treatment.

Management of Impacted Canines: Early diagnosis and interception is the most desirable approach for managing impacted maxillary canines. However, in the absence of

prevention, clinicians should consider orthodontic treatment followed by surgical exposure of the canine to bring it into occlusion. In such a case, interdisciplinary approach is essential, as it will allow for the appropriate surgical and orthodontic techniques to be used. The most common methods used to bring palatally impacted canines into occlusion are surgically exposing the teeth and allowing them to erupt naturally during early or late mixed dentition and surgically exposing the teeth and placing a bonded attachment to and using orthodontic forces to move the tooth [19]. According to Dewel [20] maxillary canines have the longest period of development, as well as the longest and most tortuous course to travel from the point of formation, lateral to the piriform fossa, until they reach their final destination in full occlusion. Broadbent advised to be wary of correcting flared and distally tipped lateral incisors before eruption of canines to check canine impaction or root resorption of the lateral incisors. Orthodontists should first create adequate space in the dental arch to accommodate the impacted canine and then surgically expose the tooth to give them access so that they can apply mechanical force to erupt the tooth. Canine exposure often leads to a compromised keratinized gingiva, an adequate amount of keratinized gingival is a fundamental requirement for periodontal health According to Kokich [21] there are three methods for uncovering a labially impacted maxillary canine: gingivectomy, creating an apically positioned flap, and using closed eruption techniques (Figure 4). Once canine exposed different methods of attachment to the impacted tooth have been suggested, including crowns, wire ligatures, chain links, bands, and directly bonded brackets.



**Fig 4:** Recommended surgical techniques relative to the mucogingival junction (MGJ) when the canine cusp is (a) coronal to the MGJ: gingivectomy; (b) apical to the MGJ: creating an apically positioned flap; and (c) significantly apical to the MGJ: using a closed eruption technique.

A summary of different technique is give given in Table 1. It is very important to maintain tip and torque while retracting and to prevent rotational side effects. If the canine is near the incisor roots and a buccally directed force is applied, it can lead damage to lateral incisors root, so attention should be given. It is important to remember that first premolars should not be extracted until a successful attempt is made to move the canines using a bonded attachment and orthodontic forces to bring the impacted canines into occlusion. Orthodontists should consider treatment alternatives, such as auto transplantation or restoration, in collaboration with other specialists, including oral surgeons, periodontists, and prosthodontists. The patient should be informed about all the potential complications before surgical and orthodontic interventions take place.



## Retention

According to Becker *et al* [22] an increase incidence of rotations and spacing on the impacted side in 17.4% compared to control side of 8.7%. To minimize rotational relapse, a fibrotomy or a banded fixed retainer can be considered. Clark suggested by removing halfmoon shaped wedge of tissue from lingual aspect of canine, palatally drifting can be prevented [18].

## Conclusion

An interdisciplinary holistic approach to treatment will lead to achievement of the desired aesthetic & functional. It also necessary that we evaluate the prognosis before and after through diagnosis. It is always important to observer and take proper decision regarding treatment and it should be always in interest of patient benefits and consent should take after giving all treatment alternatives.

**Table 1:** Summary of different technique

No	Orthodontic Technique	Year of Study	Study
1	Ballista spring	1979	Harry Jacobay [23]
2	Tunnel traction	1994	Criscini <i>et al</i> [24]
3	Magnets	1994	Ali Darendeliler [25]
4	Stainless steel archwire auxillary	1995	Becker <i>et al</i> [26]
5	Cantilever spring	1995	Lindauer and Isaacson [27]
6	TMA box loop	1995	Lindauer and Isaacson [28]
7	Two archwire technique	1997	Samuels [28]
8	Nickle-titanium closed coil spring	1999	Loring L.Ross [29]
9	Mandibular anchorage	1999	Pramod K.Sinha [30]
10	The K-9 spring	2000	Varun Kalra [31]
11	Australian helical archwire	2000	Christine Hauser [32]
12	The monkey hook	2002	Jay Bowman [33]
13	Temporary anchorage devices	2004	Dillingham Park [34]
14	Easy-way-coil spring	2008	Michael Schubert [35]

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