

Impacted Maxillary Canines and Their Management

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Abstract: Canine impaction is most commonly encountered problem in the eruption sequence of permanent teeth. Etiology varies from in each patient. Three quarters of its final root length. The mandibular central incisors and first molars have marginally less root development and mandibular canines and second molars marginally more when they erupt. This therefore can be taken as a diagnostic baseline from which to assess the eruption of teeth in general. Incidence of maxillary canine is more compared to mandibular canine

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I. Introduction

The ectopic eruption and impaction of maxillary permanent canines is a frequently encountered clinical problem. The diagnosis and treatment of this problem usually requires the expertise and cooperation of the general practitioner, the pediatric dentist, the oral surgeon, periodontist, as well as the orthodontist. An overview of the incidence and sequelae as well as the surgical, periodontal and orthodontic considerations in the management of impacted canines is presented here.

Development Considerations

According to Devel, maxillary canines have the longest period of development, as well as the longest and most tortuous course to travel from point of formation, until they reach their final destination in full occlusion. During their course of development, the crowns of the permanent canines are intimately related to the roots of the lateral incisors. Throughout the period of its downward progress, the permanent canine is conspicuously palpable on the buccal side of the alveolar ridge, from as early as 2-3 yrs period to its normal eruption, which normally occurs at the age of 11-13 yrs.

When is a Tooth Considered to be Impacted?

From the work of Gron (1962), it is learned that under normal circumstances a tooth erupts with a developing root and with approx. Three quarters of its final root length. The mandibular central incisors and first molars have marginally less root development and mandibular canines and second molars marginally more when they erupt. This therefore can be taken as a diagnostic baseline from which to assess the eruption of teeth in general. Thus should an erupted tooth have less root development, it would be appropriate to label it as prematurely erupted. At the opp. end of the scale, we find the unerupted tooth that exhibits a more completed developed roots, the normal eruption process of this tooth must be presumed to be impeded.

Incidence of Canine Impaction

1. Incidence of maxillary canine impaction : 0.92% (Dachi and Honell, 1961) & 1.7% (Ericson & Kurol, 1986).
2. Incidence of mandibular canine impaction 0.35% (Dachi and Honell)
3. A ratio of twelve palatably impacted canines for one labially impacted canine (Jaloby)
4. Cumulative prevalence of canine impaction in 7-13 Yr old children : 2.2% (Thilander & Myrberh, 1943).
5. Of all patients with maxillary impacted canines 8% have bilateral impactions.
6. Impactions twice as common in females (1.17%) than in males (0.51%).

Etiology of Maxillary Canine Impaction (Multifactorial)

Bishara and associates summarised Moyer's theory that impacted canine is caused by :

1. Primary (Localized)
 - (a) Tooth size-arch length discrepancies.
 - (b) Prolonged retention or early loss of deciduous canine.

- (c) Abnormal position of the tooth bud (rotation of tooth buds).
- (d) Trauma to the deciduous tooth bud.
- (e) Disturbances in the tooth eruption sequence.
- (f) Presence of an alveolar cleft.
- (g) Ankylosis
- (h) Cystic or neoplastic formation
- (i) Dilaceration of the root
- (j) Premature root closure
- (k) Iatrogenic
- (l) Idiopathic

2. Secondary (Generalised)

- (a) Abnormal muscle pressure
- (b) Febrile diseases
- (c) Endocrine disturbances
- (d) Vitamin D deficiency
- (e) Irradiation.

Sequelae of Impaction (Shafer et al)

- (a) Labial or lingual malpositioning of the impacted tooth.
- (b) Migration of the neighbouring teeth and loss of arch length.
- (c) Internal resorption
- (d) Dentigerous cyst formation
- (e) External root resorption of the impacted as well as neighbouring teeth.
- (f) Infection particularly with partial eruption
- (g) Referred pain
- (h) Combinations of the above (or) NO untoward effects.

Normal Sized Lt. Incisor	→	Early Dev. Root	→	↑	Chance of Resorption
Anomalous Lt. Incisor (Peg or small Md crown width)	→	Small Late Dev. Root	→	↑	Chance of Resorption

II. Diagnosis of Impaction

The proper localization of the impacted tooth plays a crucial role in determining the feasibility of as well as the proper access for the surgical approach and the proper direction for the applications of orthodontic force.

Clinical Evaluation

The following signs might be indicative of canine impaction.

1. Delayed eruption of the permanent canine or prolonged retention of the deciduous canine beyond 14 to 15 years of age.
2. Absence of a normal labial canine bulge.
3. Presence of a palatal bulge.
4. Delayed eruption, distal tipping or migration of the lateral incisor.

Radiographic Evaluation

Various radiographic exposures like occlusal films, panoramic views, Lt. cephalograms help in evaluating the position of the canines. Periapical films are sometimes uniquely reliable for the same purpose.

2sw (i) Periapical Films

Only a two dimensional representative of the dentition in a single periapical films i.e. only mesiodistal and superoinferior relationships are seen. For bucco-lingual relationship a second periapical film is obtained.

Tube Shift Technique

Two periapical films are taken of the same area with the horizontal angulation of the cone changed when the second film is taken.

If the object in question moves in the same direction as the cone, it is lingually positioned. If the object moves in the opposite direction it is situated close to the source and is therefore buccally placed.

(ii) Occlusal Films

To determine the buccolingual position of the impacted canine (provided the image of impacted canine is not superimposed on the other teeth).

(iii) Extra Oral Films

- (a) Frontal and Lt. cephs for determining the position of the impacted canine, particularly its relationship to other facial structures (eg maxillary sinus and the floor of the nose).
- (b) Panoramic films to localize impacted teeth - bilateral impactions can be visualised simultaneously.

CT 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. Especially when root resorption of Lt. Incisor is suspected. CT scanning is a method in which clear serial radiographs may be taken at graduated depths in any part of the human body.

Advantages of CT Scanning Include

- (i) Technique allows elimination of the super imposition of other structure that we have seen will obscure the image of the object that we attempt to view in traditional radiography.
- (ii) By viewing serial radiographic 'Slices' of the maxilla, the relationship of the impacted tooth to the adjacent teeth, in all three planes of space, may be accurately assessed.
- (iii) The method may also give accurate information regarding early root resorption particularly of the buccal and palatal surfaces. This may not be possible to diagnose by any other method, prior to treatment.

Word of Caution

Although the CT has excellent potential for diagnosis of the position of the impacted and supernumerary teeth, the large dosage of radiation and costs is difficult to justify for all cases, except an exceptional one. CT scan is indicated in patients in whom there is a suspected displacement of the long axis of the tooth, due to an abnormal orientation of the root apex or the suspected presence of root resorption (Ericson and Kurol, 1988).

Prognosis

Deep infraosseous location of the impacted canine can be assessed on the panoramic image by using the modified version of the criterion proposed by Ericson and Kurol.

Criteria used to define deep infraosseous impaction.

The tracing is made on panoramic radiographs.

The following lines are drawn and measurements made

- (a) The midline
- (b) The occlusal plane (From the first molar to the incisal edge of the central incisor).
- (c) The long axes of C.I, L.I, first bicuspid and of the impacted canine.
- (d) The angle between the long axis of the impacted canine and the midline (x)
- (e) The distance between the cusp of the impacted canine and the occlusal plane.

The Criteria to Evaluate the position of the impacted canine

- (i) The most medial position of the crown is identified and severity of the overlap assessed. Canines placed mesial to Lt. incisor, distal to premolar, success rate is less.
- (ii) The inclination or angulation of the long axis of the canine is measured in relation to the midline (Angulation greater than 40° shows poor prognosis).
- (iii) The vertical height in millimeters from the canine tip to the occlusal plane ($\varnothing > 15\text{mm}$ again reveals poor prognosis).

PREVENTION OF MAXILLARY CANINE IMPACTIONS

- (i) When the clinician detects early signs of ectopic eruption of the canines, an attempt should be made to prevent their impaction and its potential sequelae.

Ericson and Kurol suggested that removal of the deciduous canine before the age of 11 yrs will normalize the position of the ectopically erupting permanent canine 91% of the cases, if the crown is distal to the midlines of the Lt. incisor.

Success rate is only 64% if the canine crown is mesial to the midline of the Lt. incisors.

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:

- (a) 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. Eventually its root will resorb and the canine will have to be extracted.
- (b) Auto transplantation of the canine.
- (c) Extraction of the impacted canine and movement of a first premolar in its position. B and C both require meticulous handling.
- (d) Extraction of the canine and post segmental osteotomy to move the buccal segment mesially to close the residual space, which is a tedious surgical procedure.
- (e) Prosthetic replacement of the canine, not amenable for juvenile patients.
- (f) Trans alveolar transplantation of maxillary canines reported by Soren sagne et al Ajodo 86' as an alternative to orthodontic treatment of impacted maxillary canines in adult patients. Minimal surgical trauma to the tooth, preparation of a sufficient socket for the tooth, and avoidance of trauma to the cementum and periodontium. Neglect of any of these details, in the operative technique may cause resorption.
- (g) Surgical exposure of the canine and orthodontic treatment to bring the tooth into the line of occlusion. This is obviously the most desirable approach.

When to Extract an Impacted Canine?

The extraction of canine, although seldom considered might be a suitable option in the following situations.

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 on 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 and 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.

Palatal Versus Labial Impactions

- It is estimated that the incidence of palatal impaction exceeds that of labial impaction by a ratio of at least 2:1 or 3:1
- Ectopic labially positioned canines may erupt on their own without surgical exposure and orthodontic treatment, frequently high in the sulcus or alveolar ridge.
- On the other hand, palatably impacted canines seldom erupt without intervention, it is beceived that this impeded eruption is due to the thickness of the palatal cortical bone, as well as the dense, thick and resistant palatal mucosa.
- Palatably impacted canines are more often inclined in a horizontal / oblique direction, where as labial impactions offer a more favouable vertical angulations.

Periodontal Considerations

- Earlier methods of uncovering impacted canines advocated radical bone removal to expose the crown of the impacted tooth so as to remove all bony obstacles and to provide an easier path for tooth movement.
- Mc Donald and yap evaluated the relationship between the amount of bone removed during surgical exposure and the subsequent bone loss around the impacted tooth.
- They found that the more bone removed initially, the greater the bone loss after orthodontic treatment.
- Kohavi et al. compared the periodontal health of canines exposed by such a "Radical" exposure with those exposed by a more conservative "Light" exposure. In the latter group, the exposed area was kept coronal to the cemento - enamel junction (Cej).
- Comparisons between the two groups indicated the absence of significant differences in the plaque index, the gingival index, pocket depth or attached gingivae after treatment. However, there were significant difference in bone supports i.e alveolar bone support in the heavy exposure group was reduced.

- It was concluded that exposure of the Cej was a critical variable and should be avoided as an objective during surgery.
- Kohavi et al suggested that light movements like tipping cause significantly less bone loss than heavy movements (E.G torque) during the traction of the impacted tooth.
- It can therefore be concluded that the combined effects of light surgical exposure and light orthodontic movements and forces, are beneficial to the future periodontal health of the tooth since they minimize the loss of alveolar bone support and potential injury to the tooth during traction.
- It should be reemphasized that in surgical exposure of an impacted tooth, only enough bone should be removed for the bracket placement and the Cej should not intentionally exposed.

RETENTION CONSIDERATIONS

- Becker et al evaluated the post treatment results of the impacted canines in patients whose orthodontic treatment had been completed.
- They observed an increased incidence of rotations and spacing on the impacted side in 17.4% of the cases, whereas on the control side the incidence was only 8.7%.
- To minimize or prevent rotational relapse, a fibrotomy or a bonded fixed retainer may be considered by the clinician.
- Clark suggested that after the alignment of palatally impacted canines, the lingual drift can be prevented by removal of a halfmoon shaped wedge of tissue from the lingual aspect of the canine.

III. Conclusion

- The management of severely impacted canine is often a complex undertaking and requires the joint expertise of a number of clinicians.
- It is important that these clinicians communicate with each other to provide the patient with an optimal treatment plan based on scientific rationale.

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