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Management of impacted canine in orthodontics

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Abstract

Impaction of maxillary and mandibular canines is a frequently encountered clinical problem, the treatment of which usually requires an interdisciplinary approach. An impacted tooth is often left unidentified due to the lack of symptoms. It is generally found when the patient is examined by a dentist. The maxillary canine should be retained for strength masticatory functions, esthetics and child development. 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. Hence, it seems worthwhile to focus on the means of early diagnosis and interception of this clinical situation. In the present article, a review of the incidence and sequelae, as well as the surgical, periodontal, and orthodontic considerations in the management of impacted canines is presented.

Keywords: Maxillary and Mandibular, Genetic Theory

Introduction

The orthodontic treatment of impacted maxillary canine is one of the major challenges faced by today's clinicians. The treatment protocols usually involve surgical exposure of the impacted tooth, followed by alignment. Some of the common complications include bone loss, root resorption, and gingival recession around the treated teeth. This is pertinent that early diagnosis and intervention can save a lot of time also from more complex treatment in the permanent dentition.

Tooth impaction has been defined as the intraosseous position of the tooth after the expected time of eruption, whereas the anomalous intraosseous position of the canine before the expected time of eruption can be defined as a displacement. Most of the time, palatal displacement of the maxillary canine results in impaction.[1,2]

This is also pertinent that if it is diagnosed early then the impacted canine can be guided into appropriate location using interceptive orthodontic treatment protocols.

Incidence and Prevalence

Maxillary canines are the second most commonly impacted teeth. [2] Maxillary canine impaction occurs in approximately 2% of the population and is twice as common in females as it is in males. The incidence of canine impaction in the maxilla is more than twice that in the mandible. Of all patients who have impacted maxillary canines, 8% have bilateral impactions.[3] Approximately one-third of impacted maxillary canines are located labially and two-thirds are located palatally. [4,5] The exact etiology of palatally displaced maxillary canines is unknown. The results of Jacoby's [6] study showed that 85% of palatally impacted canines had sufficient space for eruption, whereas only 17% of labially impacted canines had sufficient space. Arch length discrepancy is thought to be a primary etiologic factor for labially impacted canines.[5] Several etiologic factors for canine impactions have been proposed: localized, systemic, or genetic [Table 1].[1]

Table 1

Localized

1. Tooth size–arch length discrepancies
2. Failure of the primary canine root to resorb
3. Prolonged retention or early loss of the primary canine
4. Ankylosis of the permanent canine
5. Cyst or neoplasm
6. Dilaceration of the root
7. Absence of the maxillary lateral incisor
8. Variation in root size of the lateral incisor (peg-shaped lateral incisor)
9. Variation in timing of lateral incisor root formation
10. Iatrogenic factors
11. Idiopathic factors

Systemic

1. Endocrine deficiencies
2. Febrile diseases
3. Irradiation

Genetic Heredity

Malposed tooth germ

Presence of an alveolar cleft

Guidance theory postulates that the roots of lateral incisor guide the canine during eruption and if it is malposed or missing then this leads to impaction of canine. The genetic theory points to missing or small lateral incisors as a genetic factor for palatally displaced maxillary canines.[9] Baccetti [10] reported that palatally impacted maxillary canines to be genetically associated with enamel hypoplasia, infra-occlusion of primary molars, aplasia of second premolars, and small maxillary lateral incisors.

Repercussions of Impacted Canine

In a study conducted by Shafer et al in 1963, concluded following ill effects of Impacted Canine:

1. Labial or lingual malposition Ing of the impacted tooth,
2. Migration of the neighboring teeth and loss of arch length,
3. Internal resorption,
4. Dentigerous cyst formation,
5. External root resorption of the impacted tooth, as well as the neighboring teeth,
6. Infection particularly with partial eruption, and
7. Referred pain and combinations of the above sequelae.

A study conducted by Ericson R et al in 1986 showed that in 0.71% of children in the 10–13-year age group, permanent incisors have resorbed because of the ectopic eruption of maxillary canines.[12]

Diagnosis of Canine Impaction

Diagnosis of Impacted Canine can be made using both Clinical and Radiographic observations.

- Clinical Examination: According to various studies following clinical signs might be indicative of canine impaction:[3]

A. Delayed eruption of the permanent canine or prolonged retention of the deciduous canine beyond 14–15 years of age,

B. Absence of a normal labial canine bulge,

C. Presence of a palatal bulge, and

D. Delayed eruption, distal tipping, or migration (splaying) of the lateral incisor.

According to Ericson and Kurol,[12] the absence of the "canine bulge" at earlier ages should not be considered as indicative of canine impaction. Hence it can be said that the clinical examination should be supplemented with radiographic examination to reach a conclusion.

- Radiographic Examination: with advancements in technology, we have a plenty of radiographic techniques available. But it can be said that in most cases the simple I.O.P.A. radiographic technique is uniquely reliable for the same.

A. Periapical Films: A periapical film gives us idea about the mesiodistal and superior-inferior relation of tooth. For buccolingual relation of tooth, we need to make subsequent radiographs using either of the following techniques:

a. Tube Shift Technique/ Clarks rule/ SLOB rule

b. Buccal Object rule

B. Occlusal Films: buccolingual position of the impacted canine in conjunction with the periapical films can be estimated using occlusal films, only condition being that the teeth should not be superimposing on one other.

C. Extraoral Radiography: these include panoramic radiograph, Lateral Cephalograms, CBCT etc. These techniques

require costly equipment and are expensive for the patient, hence may not be possible in every case. This is the major drawback which limits its use.

Interceptive Orthodontics

If the clinician is able to detect early signs of ectopic eruption of the canines, attempt should be made to prevent impaction and its potential repercussions. Selective extraction of the deciduous canines as early as 8 or 9 years of age has been suggested by Williams as an interceptive approach to canine impaction in Class I uncrowded cases. Ericson and Kurol [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.

Treatment Alternatives during Interceptive phase: Following are treatment alternatives for Impacted can if detected early:

1. No treatment is advised if the patient is not willing for the same. Such patients should be put on routine checkups and should be tried to motivate.
2. Shifting of Premolar in position of Canine after its extraction.
3. Auto transplantation of Canine.
4. Extraction of canine followed by posterior segmental osteotomy to close the space.
5. Orthodontic alignment of canine in arch after surgically exposing it.
6. Prosthetically rehabilitating the missing canine.

Extraction of impacted Canine is suggested only when:

1. The tooth is ankylosed.
2. The tooth is showing signs of internal or external resorption.
3. The tooth has severe dilaceration which will make transplantation impossible.
4. Patient is having normal occlusion.
5. The tooth with signs of pathology like cyst or abscess.
6. If the patient isn't willing for orthodontic treatment and wants to get the tooth extracted.

Management of Impacted Canine

The most desirable approach for managing impacted maxillary canines is early diagnosis and interception of potential impaction. 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, open communication between the orthodontist and oral surgeon 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.[14] Kokich [15] reported three methods for uncovering a labially impacted maxillary canine: gingivectomy, creating an apically positioned flap, and using closed eruption techniques.

Orthodontists have recommended that other clinicians 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. Although various methods work, an efficient way to make impacted canines erupt is to use closed-coil springs with eyelets, as long as no obstacles impede the path of the canine.

If the canine is in close proximity to the incisor roots and a buccally directed force is applied, it will contact the roots and may cause damage. In addition, the canine position may not improve due to the root obstacle. Consequently, various techniques have been proposed that involve moving the impacted tooth in an occlusal and posterior direction first and then moving it buccally into the desired position. When using a bonded attachment and orthodontic forces to bring the impacted canines into occlusion, it is important to remember that first premolars should not be extracted until a successful attempt is made to move the canines. If the attempt is unsuccessful, the permanent canines should be extracted.

A summary of orthodontic techniques used to manage impacted canines is given in Table 2.

In such cases, the orthodontist has to decide if the premolar should be moved into the canine position. 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 of the potential complications before surgical and orthodontic interventions take place.

Table 2

Study	Orthodontic technique
D. Harry Jaco bay [16] (1979)	Ballista spring
E. Criscini et al. [17] (1994)	Tunnel traction
F. Ali Darendeliler [18] (1994)	Magnets [19]
G. Becker et al. [8] (1995)	Stainless steel archwire auxiliary
H. Lindauer and Isaacson [20] (1995)	Cantilever spring
I. Lindauer and Isaacson [20] (1995)	TMA box loop
J. Samuels [21] (1997)	Two archwire technique
K. Loring L. Ross [22] (1999)	Nickel titanium closed-coil spring
L. Pramod K. Sinha [23] (1999)	Mandibular anchorage
M. Varun Kalra [24] (2000)	The K-9 spring
N. Christine Hauser [25] (2000)	Australian helical archwire
O. Jay Bowman [26] (2002)	the monkey hook

Conclusion

The management of impacted canines 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. When patients are evaluated and treated properly, clinicians can reduce the frequency of ectopic eruption and subsequent impaction of the maxillary canine.

The simplest interceptive procedure that can be used to prevent impaction of permanent canines is the timely extraction of the primary canines. This procedure usually allows the permanent canines to become upright and erupt properly into the dental arch, provided sufficient space is available to accommodate them.

Various surgical and orthodontic techniques may be used to recover impacted maxillary canines.[28] The proper management of these teeth, however, requires that the appropriate surgical technique be used and that the clinician be able to apply measured forces in a favorable direction. This allows for complete control in efficient correction the impaction and for avoidance of damage to adjacent teeth. Careful selection of surgical and orthodontic techniques is essential for the successful alignment of impacted canines.

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