

Review Article

Maxillary canine impaction - A hitch in orthodontic treatment planning

G. Sunil^{1*}, I. Ranganayakulu², R.S.V.M. Raghu Ram³

¹Principal, Professor and Head, ²Senior Lecturer, ³Reader

Department of Orthodontics and Dentofacial Orthopedics, GSL Dental College and Hospital, Rajahmundry, Andhra Pradesh, India

*Corresponding author email: drghantasunil@gmail.com

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Abstract

Maxillary canine has a significant importance in functional and esthetic aspect of the occlusion. Clinicians must have a sound knowledge regarding the management of impacted maxillary canines as is second most common teeth prone for impaction after third molars. With early detection and timely interception and well planned orthodontic treatment the impacted canines can be successfully brought to the occlusion. This article gives an overview of etiology, diagnosis and prognosis of impacted canine.

Key words

Impacted maxillary canine, Orthodontic treatment, Occlusion.

Introduction

The management of impacted canines is important in terms of esthetics and function. The management of impacted canines usually involves different options; radiographic monitoring for cystic formation, interceptive treatment, surgical exposure and orthodontic traction and finally surgical extraction. Orthodontists must formulate treatment plans that are in the best interest of the patient and they must be knowledgeable about the treatment

difficulty and variety of treatment options. This review article gives birds view regarding the etiology development and prognosis of impacted maxillary canine

Prevalence

Maxillary canine the second most commonly impacted tooth, after third molars and has been reported in about 1% to 2% of the population [1-5]. Studies show that women are twice as likely as men to have impacted maxillary canines [1]. It

was found that unilateral impaction is much more common than bilateral impaction. Maxillary impacted canines occur palatally 85% of the time while only 15% of impactions occur labially [1-6]. Al-Nimri, et al. stated that palatal canine impaction occurred most frequently in subjects with a Class II division 2 malocclusion [7]. Among all patients with impacted canines, maxillary canine impactions appear to be 10 to 20 times more frequent than those in the mandible [1-5, 8].

Development

The development of Canine commences at 4–5 months of age, high in the maxilla, lateral to the piriform fossa, and has the longest path of eruption at 22 mm [9]. Crown calcification starts at 1 year, between the roots of the deciduous first molar, and is complete at 5–6 years of age. It then migrates forward and downwards to lie buccal and mesial to the apex of the deciduous canine, then continues to move down the distal aspect of the root of the upper lateral incisor. Maxillary canines erupt on average at 11–12 years of age, erupting earlier in females than in males [10].

Etiology of canine impactions

The etiology of impacted maxillary canines is thought to be multi-factorial, however, the exact etiology is still unclear [5]. Possible causes for impacted canines may include one or more of the following local factors [1-5]

- Inadequate space for eruption or early loss of primary canines
- Abnormal position of the tooth bud
- The presence of an alveolar cleft
- A cystic lesion or neoplasm
- Ankylosis
- Idiopathic condition for no apparent reason.
- Systemic conditions such as endocrine deficiencies, malnutrition, febrile disease, or irradiation can also account for impacted canines.

Theories for canine impaction

Currently, there are 2 major theories that have been used to explain the cause of maxillary canine impaction: the guidance theory and the genetic theory. The guidance theory proposed by Becker, et al., in 1981 states that absent or malformed lateral incisor root causes the canine to lose its way and erupt improperly, because a permanent canine tooth needs the distal aspect of a lateral incisor's root to guide it downward to the occlusion [11]. Becker concluded that palatally impacted canines were very closely associated with spaced dentitions and lateral incisors that are peg-shaped, of small mesiodistal width, or congenitally absent. The genetic theory proposed by Peck, et al. in 1994, concludes that palatally impacted canines are the result of a combination of multiple gene expressions which cause dental anomalies such as congenital missing or peg shaped lateral incisors [11, 12].

Investigations

Investigations for impacted canines should be carried out clinically and radiographically. Clinical assessment will involve visual inspection and palpation.

Clinical diagnosis

Clinical examination includes overall arch inspection, palpation of canine bulges, mobility of primary canines, and a review of the patient's chronological age and history of eruption/exfoliation patterns of the dentition. Clinicians should be aware that there is a possibility of canine impaction in the absence of canine bulges, abnormality in shape, missing lateral incisors, or less mobility of primary canines [1-5]. In addition, the colour and mobility of the deciduous canine should be inspected as this might indicate resorption of the root. A longitudinal study done on 505 school children revealed that positive palpation indicated a good prognosis for eruption and in 92% of cases palpation was positive [13].

The following clinical signs might be indicative of canine impaction:

- (1) Prolonged retention of the deciduous canine beyond 14 to 15 years of age,
- (2) Absence of a normal labial canine bulge on palpation.
- (3) Presence of a palatal bulge
- (4) Delayed eruption, distal tipping, or migration (splaying) of the lateral incisor.

However, the absence of the "canine bulge" alone should not be considered as indicative of canine impaction. It should be supplemented with a radiographic evaluation [14].

Radiographic diagnosis

When clinical signs lead to a possibility of canine impaction, radiographic evaluation is needed to confirm the diagnosis and assist in developing an appropriate treatment plan. Panoramic radiographs are also widely used to locate the position of impacted canines. They are part of the fundamental imaging taken for dental records and treatment planning. Occlusal radiographs can identify the position of impacted maxillary canines accurately in conjunction with routine periapical radiographs. The disadvantage of this radiograph is that it cannot provide any information about the vertical position of the canines. If there is any concern of impaction with other anomalies, it might be better to utilize cone beam computed tomography (CBCT) instead. CBCT has the great advantage of showing hard-tissue reconstruction in the area of interest in 3 dimensions, presenting a view without any superimposition, and also providing a 1:1 magnification [15]. CBCT scans are superior than conventional panoramic radiographs in verifying the orientation and location of the impacted canine and its relationship to neighboring structures [6]. This technique makes identification of the exact position and shape of impacted canines possible, which is crucial in treatment planning and are very helpful in evaluating damage to adjacent teeth and the amount of surrounding bone [16].

Sequelae of impactions

Possible sequelae of impacted canines include cyst formation, internal resorption of the impacted tooth, external resorption of impacted or neighboring teeth, ankylosis, infection and migration of neighboring teeth with loss of arch length [17]. Research reveal that Resorption and pathology are more likely in females, in age groups greater than 14 years, and in cases where the angulation of the canine to the midline is more than 25° [18]. Ericson and Kurol revealed that resorption on the roots of incisors adjacent to ectopically positioned canines occurred in 38% of lateral and 9% of central incisors, in a study done 107 children with impacted canines. Ericson and Kurol concluded that resorption on maxillary incisors after ectopic eruption of canines was more common than previously thought. CT scanning increased detection of root resorption by 50%. The most likely cause of root resorption is inherent pressure due to migration of the displaced erupting canine, combined with physical contact between the root of the incisor and prominences on the canine crown [19]. However, the response of incisors with resorbed roots following treatment of impacted canines was assessed by Becker and Chaushu, et al., and they suggested that, once the impacted canine had been moved away, there is no risk for further resorption [20]. Falahat, et al., in their follow-up of root resorption, also showed that root resorption associated with ectopic canines, in most cases, did not threaten the long-term viability of the affected incisor, even when resorption was severe [21].

Assessment of impacted canine and prognosis

McSherry, et al., suggested the following factors to estimate treatment difficulty [22].

- The closer the canine lies to the midline, the poorer the prognosis for alignment. No horizontal overlap of the adjacent incisor would indicate good prognosis, overlap up to half the root width suggests average prognosis and complete overlap of root would indicate poor prognosis.

- Vertical height of the canine crown. The more apical the position of the crown, the poorer the prognosis for alignment. From the level of the cementoenamel junction to less than halfway up the root of the lateral incisor would indicate a good prognosis; more than halfway up the root but less than the full length root length would indicate average prognosis; and above the full length of root would have poor prognosis.
- Canine angulation to the midline. As canine angulation to the midline increases, the prognosis decreases. Angulation of 0–15° would point towards a good prognosis, angulation of 16–30° an average prognosis, and angulation of 31° or more, a poor prognosis.
- The position of the canine root apex in the horizontal plane. If the canine apex is located above the normal canine position, prognosis for alignment is good, if the apex is above the first premolar region, prognosis is average, and if it is above the second premolar, prognosis is poor.

McSherry and Pitt, et al., have provided the evidence basis for these prognostic indicators [22].

The above criteria aids in decision-making regarding management of cases. According to the criteria, if canine prognosis is good in all four categories, then a decision may be made by the orthodontist to extract the deciduous canine which allows ‘spontaneous eruption of the impacted canine. If the canine fails to erupt or improve within 12 months, the orthodontic treatment will most likely be exposure and alignment [23]. In cases where prognosis is average, that is two categories suggest a good prognosis and two suggest an average prognosis, definitive treatment could be the extraction of the canine, depending on the overall malocclusion and the associated factors, such as patient age,

crowding and condition of the dentition. If one or more of the criteria suggest a poor prognosis, or there is evidence of pathology, then orthodontic treatment is essential and the deciduous canine should not be removed. In these cases, all factors must be carefully considered before a decision on definitive treatment is made.

Conclusion

Maxillary canine impaction a complex problem can be addressed successfully with timely diagnosis and planned orthodontic treatment protocol. Thorough knowledge about development, diagnosis and etiology of the canine helps the clinician to address the issue with minimal difficulty.

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