

## An Overview Of Maxillary Canine Impaction

### Abstract

Disturbances in the eruption of canine is a frequently encountered clinical problem in orthodontics. Early detection and timely interception results in successful management of the malocclusion. Although the overall prevalence of impacted maxillary canine is low, it is second only to the impacted mandibular third molar in its frequency of occurrence. In selected cases, extraction of impacted canine is indicated to minimize the risk and facilitate treatment. Since canine is a key tooth for the integrity of the arch and to maintain stability of the treatment, canine extraction can compromise esthetics, function and occlusion of the finished case. The most common treatment procedure for the impacted canine is surgical exposure of the canine followed by treatment with orthodontic mechanotherapy. This article presents an overview of the incidence, etiology, unfavourable sequelae, diagnosis and management of impacted maxillary canine.

### Key Words

Impaction, Maxillary Canine, Etiology, Diagnosis & Management.

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Date of Submission : 25<sup>th</sup> November 2010

Date of Acceptance : 30<sup>th</sup> March 2011

### Introduction:

In most individuals, permanent teeth will erupt uneventfully and replace their primary successors. However, in some these unerupted teeth are diverted or angulated aberrantly and lose their potential to erupt. According to Shafer, Hine and Levy, impacted teeth are those which are prevented from erupting by some physical barrier in the eruption path. The permanent maxillary canine is second only to the mandibular third molar in its frequency of impaction. The ectopic eruption and impaction of maxillary permanent canine is a frequently encountered problem in orthodontics. An overview of the incidence, etiology and sequelae as well as the surgical and orthodontic considerations in the management of impacted canines is presented here.

### Incidence:

Incidence of maxillary canine impactions vary from 0.92% - 1.7%.<sup>1,2</sup> Impactions are twice as common in females(1.17%) than males(0.51%). Impacted canines are found palatally in 85% of the cases, with labial position in 15% of cases.<sup>3,4</sup>

### Developmental Considerations:

Moss states that canine remains in maxilla just above the root of lateral incisors until the crown is calcified. It then erupts along the distal aspect of lateral incisors resulting in closure of the physiological diastema if present and the correction of the so called "ugly duckling stage".<sup>5</sup>

Movements of maxillary canine in three dimensions using lateral and postero-anterior cephalometric radiographs from the Belfast growth study taken annually between 5 and 15 years of age was studied. It was shown that the canine travels almost 22 mm during that time.<sup>6</sup> Also according to Dewel, maxillary canines have the longest period of development, as well as longest and most tortuous course to travel from point of formation lateral to piriform fossa, until it reaches the final destination in full occlusion.<sup>7</sup>

### Etiology:

Etiology of impacted maxillary canine is obscure and most likely it is multifactorial. In general, the causes for impacted canine may be generalized or localized.<sup>8, 9, 10</sup>

The most common causes for canine

impactions are usually localized and might be the result of any of the combinations. (a) Tooth size-arch length discrepancies (b) Prolonged retention or early loss of deciduous canine (c) Abnormal position of the tooth bud (d) The presence of an alveolar cleft (e) Ankylosis (f) Cystic or neoplastic formation (h) idiopathic condition with no apparent cause.

Other suggested cause of palatal impaction is trauma to the maxillary anterior region at an early stage of development.<sup>11</sup> Also studies have shown that the presence of lateral incisor root with the right length, formed at the right time is an important variable to guide the mesially erupting canine in a more favourable distal and incisal direction. An increase of 2.4 times in the incidence of palatally impacted canines adjacent to missing lateral incisors as compared with the general population was noted.<sup>12</sup>

A genetic predisposition was shown in some studies; the relatives of patients with palatal canines are likely to exhibit palatally displaced canines and anomalous lateral incisors.<sup>13</sup> Peck et al concluded that palatally displaced canines appear to be a product of polygenic multifactorial inheritance.<sup>14</sup> Also

Prinin et al found that palatally impacted canines are genetic and related to incisor premolar hypodontia and peg shaped lateral incisors.<sup>15</sup>

### **Sequelae Of Canine Impaction:**

Internal or external root resorption of teeth adjacent to canine is the most common sequelae. It is estimated that 0.7% of the children in the 10 to 13 year old age group have permanent incisors resorbed, as a result of canine ectopia. Resorption of lateral incisor root is more common than the central incisor. Lateral incisors are more commonly resorbed palatally and at the midroot level than at the cervical or apical regions.<sup>16</sup> Late resorption of the unerupted canine itself can occur. Loss of vitality and cystic degeneration is an uncommon sequelae and the prevalence is not known. Orthodontic treatment is not without risks which include root resorption, decalcification, periodontal damage and failure to complete treatment. Surgical risks include damage to adjacent teeth and need for re-exposure sometimes.

### **Treatment Planning Considerations:**

The ectopic or impacted canine often requires a multidisciplinary treatment involving oral surgeons and orthodontists. Localization of the impacted canine and prognosis for alignment is important when deciding the management options for patients.

### **Localization of maxillary canine:**

Localization of the unerupted canine involves inspection, palpation and radiographic evaluation. The position of the crown of the lateral incisor can give a clue as to the position of the unerupted canine; that is the crown of the lateral incisor may be proclined if the canine is lying on the labial aspect of the lateral incisor root.<sup>17</sup>

Often the crown of the unerupted canine can be palpated either in buccal position or in palatal position. There is a possibility of ectopic or impacted canine, if the canine is not palpable in the buccal sulcus by the age of 10- 11 years or if the palpation indicates an asymmetrical eruption pattern. Ericson and Kuroi recommend inspection and palpation in canine region annually from 8 years for early identification of impacted canine.<sup>3</sup>

In selected cases, computerized tomograms are helpful in accurately assessing the location and identifying root resorption of adjacent teeth however this method is rarely used because of the high cost of the equipment.

### **Radiographic Evaluation:**

Although 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. Periapical films evaluate the position of canines with sufficient accuracy in 92% of cases.<sup>16</sup> A single periapical film provides two dimensional representation of the dentition. To evaluate the position of the canine buccolingually a second periapical film should be obtained by using tube-shift technique or Clarke's rule. Occlusal film also helps in evaluating the buccolingual position of impacted canine in conjunction with periapical films.

Panoramic films are also used to localize impacted teeth in all planes of space. Buccolingual position of impacted tooth is determined based on the impacted tooth size relative to contralateral side. If the tooth is farther from the film, it will appear larger e.g. Palatally impacted tooth appears larger than the contralateral normal tooth. Proper localization of the impacted tooth plays a crucial role in determining proper access for the surgical approach and proper direction for the application of orthodontic forces.

### **Management Options:**

After the comprehensive assessment of malocclusion to localize the canine, decision on its prognosis for alignment should be made. Factors affecting prognosis include patient co-operation, age, general oral health, position of the canine in three planes of space, angulation of the canine to midline, distance from midline and relation of canine to adjacent lateral incisors.

The treatment alternatives include:

1. No treatment except monitoring.
2. Interceptive removal of primary canine.

3. Surgical removal of impacted canine.
4. Surgical exposure with orthodontic alignment.
5. Autotransplantation of the canine.

### **No treatment with periodic radiographic evaluation:**

No treatment is recommended if the canine is in good position and without contact with the lateral incisor and first premolar. But the patient has to be monitored periodically with respect to cystic degeneration, root resorption and other possible complications.

### **Interceptive treatment by extraction of deciduous canine:**

Extraction of primary canine is recommended in uncrowded arches if the patient is between 10-13 years, the maxillary canine is not palpable, and localization confirms a palatal position. In 78% of cases, palatally erupting canine's eruption path normalize within 12 months after extraction of deciduous canine.<sup>18</sup> However, extraction of the primary canine does not guarantee correction in all cases. If there is no radiographic evidence of improvement within one year after interceptive treatment, more aggressive method such as surgical exposure and orthodontic eruption is indicated.

The success of early interceptive treatment for impacted maxillary canine is influenced by the degree of impaction and age at diagnosis. If the maxillary canine crown is distal to the midline of the lateral incisor root, the success rate is proposed to be 91%. Whereas the success rate decreases to 64% if the crown is mesial to the midline of the lateral -incisor root.<sup>18</sup> Other factors which influence the prognosis include canine angulation and crowding. If the vertical angulation exceeds 31%, the chance of normal eruption after extraction significantly decreases.<sup>19</sup>

### **Surgical removal and prosthetic replacement:**

Surgical removal of impacted canines is indicated when there is poor patient co-operation or poor position for orthodontic alignment.

The following are the conditions in which

removal of ectopic canines is recommended.<sup>8</sup>

1. The degree of malposition is too great (canine is oblique or horizontal).
2. Evidence of early resorption of adjacent teeth.
3. Patient is too old for interception.
4. Good contact between lateral incisor and first premolar.
5. If it is ankylosed and cannot be transplanted.

Later the canine can be replaced by a prosthodontic restoration. Also it is possible to use the first premolar as an adequate replacement for the canine by mesiopalatal rotation and introduction of buccal root torque along with grinding of the first premolar palatal cusp.

#### **Surgical exposure:**

There are three basic methods for the surgical exposure and alignment of the impacted canine.<sup>20</sup>

1. Open surgical exposure and spontaneous eruption.
2. Open surgical exposure and packing with subsequent bonding of an auxiliary.
3. Closed surgical exposure and bonding of attachment intra-operatively.

If the canine has correct axial inclination, then open surgical exposure to allow spontaneous eruption is the treatment of choice. Excision of the gingiva over the canine with bone removal is sufficient to allow eruption of canine.<sup>21</sup>

If the canine is impacted labially or in the middle of the alveolus, three techniques can be employed to uncover the tooth. The vertical location of the tooth and the amount of the gingiva will determine the appropriate technique.<sup>22</sup> The three techniques employed are (a)Gingivectomy (b)Apically positioned flap (c)Flap or closed eruption technique.

If the tip of the labially impacted canine is coronal to the CEJ of adjacent lateral incisor and has a wide zone of gingiva, then

gingivectomy is the treatment of choice.

If the tip of the canine is apical to CEJ of adjacent lateral incisor and there is lack of adequate amount of attached gingival around the canine, then apically positioned flap should be performed. If the canine is impacted in the middle of the alveolus or high in the vestibule near the nasal spine, the closed eruption technique may be the treatment of choice.

Appropriate surgical technique should be chosen so that it exposes the canine within a zone of keratinized mucosa and without the exposure of CEJ.<sup>8</sup>

#### **Application of orthodontic traction:**

Different devices can be applied to the crown of an impacted canine, including a wire, pins, crown formers and orthodontic brackets. For many years, cervical neck wires (lasso) were a popular technique to secure a tooth, but such wires injured the root of the tooth. Securing pins into the tip of the canine damaged the crown of impacted tooth. Crown forms snapped or cemented over the crown of an impacted tooth was also popular for many years. The crown forms act as a foreign body, causing erosion of overlying tissue with ultimate exposure of the impacted tooth.

The device of choice is an orthodontic bracket. Once the orthodontic attachment has been placed on impacted canine, orthodontic traction is applied to move the canine into proper alignment. Various methods have been described for applying traction, these usually include the use of fixed appliances with a transpalatal bar and or headgear to control vertical anchorage. The maintenance of adequate space in the canine area is essential prior to application of traction.

Application of force can be in the form of elastic or wire traction. "The ballista spring" system for impacted teeth has been described by Harry Jacoby. It employs a wire loop constructed using a 0.014", 0.016" or 0.018" round wire.<sup>23</sup>

Robert Harry and Harridane described a sectional approach to maxillary canine using transpalatal arch for anchorage. They

used a 0.017" x 0.025" TMA sectional archwire from first molar to canine providing low force over a long range.<sup>24</sup>

Cantilever mechanics for treatment of impacted canines has been described by Fischer et al.<sup>25</sup> Australian helical archwire for assisting eruption of impacted canine was described by Hauser et al.<sup>26</sup> It comprises of three helices bent in 0.016" special plus Australian wire. The Australian wire is bent with helices that serve as stops against the brackets of adjacent teeth to maintain space for erupting canine. An additional incisal helix increases the resilience of the system and anchors the stainless steel ligature running to the canine attachment. K-9 spring for alignment of impacted canines was described by Varun Kalra, it comprises of a spring made of 0.017 x 0.025 inch TMA wire.<sup>27</sup>

Bowman and Carano designed monkey hook as well as kilroy spring for guiding the eruption of impacted tooth.<sup>28, 29</sup> They described two types of kilroy springs. Kilroy I applies lateral and vertically directed forces to direct the impacted tooth. Kilroy II spring was designed to produce more vertical eruptive forces for eruption of buccally impacted tooth. Magnetic forces have also been advocated by some authors to align impacted tooth. Regardless of the method of traction used, the direction of applied force should initially move the impacted tooth away from roots of the neighbouring teeth. In addition, Bishara recommends - a) use of light force (< 60gms) to move the impacted tooth b) creation and maintenance of sufficient space within the arch c) the use of base archwire of sufficient stiffness (0.018"x0.022") to resist deformation by the tractional forces applied.<sup>8</sup>

#### **Conclusion:**

A disturbance in the eruption of permanent maxillary canine is a commonly encountered clinical problem. Canines play a vital role in facial appearance, dental aesthetics, arch development and functional occlusion. Therefore orthodontists have proposed various techniques to guide the eruption of impacted teeth into proper position within the arch. Successful completion of the procedures depends on the expertise of the orthodontist as well as oral surgeon. If signs of ectopic eruption are detected early, every effort should be made

to prevent impaction and its consequences. Early intervention eliminates the need for surgical intervention and complex orthodontic treatment.

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Source of Support : Nil, Conflict of Interest : None declared