

## PARTICULAR ASPECTS OF IMPACTED MAXILLARY CANINE IN CHILDREN - A NARRATIVE REVIEW

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### ABSTRACT

Canine impactions are frequently encountered in the pediatric population. Impacted canines may pose a functional and esthetic problem for patients and can affect the neighboring teeth (incisors and premolars). Early detection and management of such pathology may help the pediatric dentist and orthodontist to prevent many unwanted local and regional complications. Various surgical and orthodontic techniques may be used to recover impacted maxillary canines. The decision to surgically correct these impacted teeth is usually made by the orthodontist. The treatment of impacted teeth requires a multidisciplinary team comprising orthodontist, pediatric dentist, dento-alveolar surgeon, and sometimes a periodontist.

**Keywords:** canine impaction, maxillary, children.

### INTRODUCTION

Malocclusions could be early detected and improved treatment outcomes could be achieved if pediatric dental growth is periodically examined by a specialist (pediatric dentist, orthodontist, etc).

Impacted teeth are defined as teeth remaining in the alveolar bone after the expected time of eruption [1]. In comparison with ectopic teeth, which are invariably displaced, impacted teeth can be placed in the correct or in a shifted position. Severely ectopic teeth may get impacted, even though the expected time frame was not exceeded [2]. According to the data from the specialty literature, the permanent upper canines are

the teeth especially prone to impaction, being placed in second place after the mandibular third molars. Maxillary canine impaction occurs in 1-2% of the general population [3-6]. Disturbances in the eruption of permanent maxillary canines are common may be because they develop deep within the maxillary bone and have the longest path to follow compared with any other tooth in the oral cavity.

Aside from their importance in an ideal mutually protected occlusal scheme, the maxillary canine also plays a key role in the esthetics and continuity of the dental arch [7]. Canines play a vital role in facial appearance, dental esthetics, arch development, and functional occlusion. As a result,

orthodontists have acknowledged the significance of retaining impacted maxillary canines and have proposed various techniques to effectively and efficiently recover these teeth.

Early successful management of ectopic permanent maxillary canines might facilitate their spontaneous eruption [8]. In cases where preventive care fails to provide much-needed results, surgical exposure or removal of the impacted maxillary canine is highly recommended.

The treatment of permanent maxillary canines is a challenging orthodontic procedure that is often required for aesthetic and functional correction. Impacted canines are a major risk factor for root resorption in adjacent teeth. Orthodontic and surgical treatment are used for correcting the position of impacted teeth [9]. According to Jacoby [10], the impacted maxillary canines have a position that is mostly palatal, the impaction being in majority of cases unilateral.

Early diagnosis of impacted teeth can be made during mixed dentition. The distance between impacted teeth and the neighboring teeth determines the treatment outcome [11]. Age can also influence the duration and efficacy of fixed orthodontic treatment. Treatment duration was found to be longer in adults than in growing individuals. Comparative studies of children and adults showed that successful fixed orthodontic treatment of impacted maxillary canines was achieved in roughly two-thirds of the study group [12]. Therefore, early diagnosis associated with younger age help provides better management of impacted teeth.

There are many diagnostic tools for dental impaction, such as a thorough physical examination by manual palpation of the gingiva-buccal sulcus and of the palatal vault. The results are confirmed by the imagistic methods [13]. Canine impaction that exceeds the normal tooth eruption timetable can be suggested by the lack of normal development of the buccal or palatal growth [14].

Complications caused by unerupted teeth can be timely diagnosed with periapical or panoramic radiographs providing different degrees of sensitivity [15].

Cone beam computed tomography (CBCT) has emerged as the method of choice in dental impaction imaging. However, financial constraints and radiation exposure hazards raise concern especially in the population affected by dental impaction that was timely diagnosed during childhood [16]. That is why the analysis of unnecessary use of radiographs and of benefits and risks is highly recommended.

## **PREVALENCE AND ETIOLOGY OF MAXILLARY CANINE IMPACTION**

Maxillary canines are the most commonly impacted teeth, second only to third molars. Maxillary canines occurs in 1-2% of the general population [3-6]. According to Bishara (1992) [17], impaction of the maxillary permanent canine is twice as common in females. On the other hand, Fournier et al. (1982) [18] considered that palatal impaction of the maxillary permanent canine has been reported to occur approximately three times more frequently

than buccal impaction. Of all patients who have impacted maxillary canines, only 8% have bilateral impactions [18].

Some common local causes of maxillary canine impaction include one or a combination of the following factors: overlying cysts or tumors, supernumerary teeth, loss of arch space, over-retained primary teeth, tooth ankylosis, root dilacerations, trauma, reconstructive surgery for cleft lip/palate repair, thickened overlying bone or soft tissue, missing adjacent lateral incisor or idiopathic [19].

Two major theories associated with palatal displaced maxillary canines are the guidance theory and genetic theory. The guidance theory proposes that the canine erupts along the root of the lateral incisor, which serves as a guide, and if the root of the lateral incisor is absent or malformed, the canine will not erupt [20]. The genetic theory points to genetic factors as a primary origin of palatal displaced maxillary canines and includes other possibly associated dental anomalies, such as missing or small lateral incisors [21].

### CLINICAL SIGNS

Various clinical signs of canine impaction are documented in the specialty dental literature. These signs include delayed eruption of the permanent canine, over-retention of the primary canine, absence of a labial bulge, presence of a palatal bulge and distal crown tipping of the lateral incisor. In this case the role of pediatric dental is very important because is the first one who can detect this problems.

Visual inspection of the canine bulge, whether it is buccal or palatal which should be seen between the lateral incisor and first premolar roots, and inspection of the angulation of the lateral incisor, a distally inclined lateral incisor may infer palatal impaction and a mesially inclined lateral incisor may indicate a buccal impaction. In addition, the color and mobility of the deciduous canine should be inspected as this might indicate resorption of the root.

Palpation of the buccal surface of the alveolar process distal to the lateral incisor from eight years of age may reveal the position of the maxillary canine and has been recommended as a diagnostic tool by Kettle [22]. Also, periodontal parameters of adjacent teeth should be recorded, including the amount of keratinized gingiva, presence of tooth mobility and attachment loss.

Baccetti (1998) [23] reported that palatal impacted maxillary canines are genetically reciprocally associated with anomalies such as enamel hypoplasia, infraocclusion of primary molars, aplasia of second premolars and small maxillary lateral incisors. Becker (2007) [20] reported an increase of 2.4 times in the incidence of palatal impacted canines adjacent to the sites of missing lateral incisors compared with palatal impacted canines in the general population. Peck et al. [21] highlights the idea that a high probability of additional dental abnormalities occurring in combination with a palatal displaced canine (such as congenital tooth absence and delayed eruption) should alert clinicians (pediatric dentists, orthodontists, etc.) to be circumspect when planning treatment.

## RADIOGRAPHIC ASSESSMENT

Several methods have been used to radiographically evaluate impacted maxillary canines. These methods include intraoral techniques (occlusal and periapical x-Ray) (figure 1, figure 2) and extraoral techniques (orthopantomograms, postero-anterior or lateral cephalometric radiographs) (figure 3).



Figure 1. Retro-alveolar radiography in orthoradial incidence.



Figure 2. Retro-alveolar radiography in mesial incidence



Figure 3. Orthopantomography – impacted 2.3.

Radiographs are required to view impacted canines in three dimensions (vertical, mesio-distal and bucco-palatal), to view the relationship to the midline and adjacent teeth and to evaluate any resorption [24]. The views commonly used for assessing ectopic canines include panoramic, periapical, cephalometric, lateral skull and maxillary occlusal. When localizing impacted canines, two radiographic views are

needed to locate the tooth in the bucco-lingual plane [25].

Orthopantomograms providing two-dimensional images lack the labio-palatal visibility of impacted canines. The analysis of pediatric impacted maxillary canines based on the five sectors of dental panoramic radiographs and further linear and angular parameters showed a poor predictive value for the impaction of permanent maxillary canines. Displacements left unnoticed and

missing early intervention may affect smile aesthetics and cause root resorption in surrounding teeth [16]. For that reason, detailed radiographic findings play a major role in avoiding later complications and unnecessary treatment delays.

Clinicians can localize canines by using advanced three-dimensional imaging

techniques. Cone-beam computed tomography (CBCT) can identify and locate the position of impacted canines accurately (Figure 4 a,b). By using this imaging technique, dentists also can assess any damage to the roots of adjacent teeth and the amount of bone surrounding each tooth

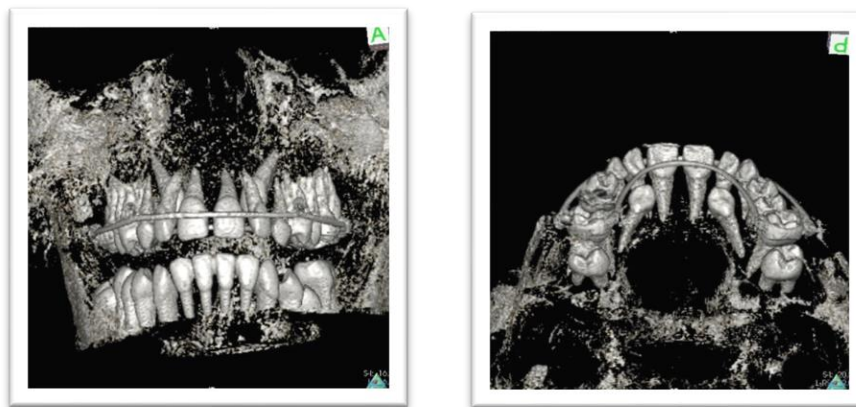


Figure 4 (a,b). CBCT reconstruction of the maxillary arch illustrating the impaction of 1.3, 2.3.

Ericson and Kurol (1988) examined prognostic factors for orthodontic treatment of maxillary impacted canines based on the radiographic presentation of orthopantomograms. According to the authors, as the canine cusp tip approaches the midline and the inclination of its long axis increases, an increased length of orthodontic treatment time is expected. In addition, the risk of root resorption of the adjacent lateral incisor is increased [11].

### SEQUELAE OF MAXILLARY IMPACTED CANINES

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.

Ericson and Kurol (1988) showed, in a study of 107 children, that resorption on the roots of incisors adjacent to ectopically positioned canines occurred in 38% of lateral and 9% of central incisors [11]. Walker et al. showed that 66.7% of lateral and 11.1% of central incisors were resorbed following the ectopic eruption of adjacent canine.

### TREATMENT OPTIONS

According to Counihan et al. (2013) [26], the management of impacted canines usually involves five treatment options:

1. No active treatment and monitor radiographically for cyst formation;
2. Interceptive treatment;

3. Surgical exposure and orthodontic alignment;
4. Surgical repositioning;
5. Extraction.

### **Interceptive treatment**

Preventing maxillary canine impaction is the ideal form of treatment. The success of early interceptive treatment for impacted maxillary canines is influenced by the degree of impaction and the patient's age at diagnosis [27].

Using panoramic techniques, Ericson and Kurol (1988) found that early extraction of primary maxillary canines may result in normal eruption of ectopically displaced permanent maxillary canines. They proposed that extracting the primary canine before the patient is 11 years of age would normalize the erupting position of the permanent canine in 91 percent of the cases if the crown were distal to the midline of the later incisor root [26]. The success rate decreases to 64 percent if the permanent canine crown is mesial to the midline of the lateral incisor root [28]. Orthodontists recommend that clinicians intercede and extract the primary canine in a timely manner to prevent impaction of the permanent canines.

Power and Short discovered that when the vertical angulation exceeds 31 percent, the chance of normal eruption after extraction significantly decreases [29]. Ericson and Kurol (1988) found that lateral incisor root resorption increases when the canine cusp tip is positioned more mesially on the lateral root [11].

### **Surgical exposure and orthodontic alignment**

There are 3 methods used for surgical exposure and orthodontic alignment:

1. Open surgical exposure
2. Surgical exposure with packing and delayed bonding of the orthodontic bracelet.
3. A surgical exposure and bonding of orthodontic bracelet intraoperatively.

If the canine has the correct inclination, the open surgical exposure is the treatment of choice. It has been shown that excision of the gingival over the canine with bone removal is sufficient to allow eruption of the canine [30].

### **Flap design**

Flap design is dictated by the location of the impacted canine. If the impacted canine is located buccally, a gingival crest incision can be made in the gingival sulcus. If the impacted canine is high, the incision can be made horizontally above the papillae. Vestibular incisions made at the level of the mucogingival junction should be made only when the impacted canine is above the root apices [31].

If the impacted canine is palatal, a palatal incision placed in the gingival sulcus can be performed. Palatal incisions placed between the gingival crest and palatal vault should be avoided because trauma to the greater palatine artery could occur [32].

### **Surgical approaches for surgical exposure with orthodontic alignment**

The closed exposure technique replaces the mucoperiosteal flap over the exposed canine after the bracket and chain is applied [33]. The disadvantage of this technique is that bonding can fail and re-exposure is necessary. If the inclination of the canine to the midline is greater than 45 degrees then the prognosis for alignment

worsens. The closer the impacted canine is to the midline the worse the prognosis [34].

### **Application of orthodontic traction devices**

Many different devices can be applied to the crown of an impacted canine. These include a wire, pins, crown formers, orthodontic brackets and temporary anchorage devices (TADs). There are 2 types of bonding agents that can be used. One is a 2-part self-cure bonding agent and the other is a light cure bonding agent. The advantage of the light cure materials is most can work in a partially wet field [31]. The tooth surface must also be acid etched. Successful bonding of the bracket improves with hemostasis. If it is a light cure material, it should be light cured for 20 to 40 seconds.

### **CONCLUSIONS**

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The impacted maxillary canine poses challenging interdisciplinary diagnoses and treatment. 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.

Treatment planning for these cases should be multidisciplinary with the oral and maxillofacial surgeon making the final decision on the surgical treatment plan. Careful selection of surgical and orthodontic techniques is essential for the successful alignment of impacted maxillary canines.

The simple efficient and effective interceptive treatment of the maxillary canine impaction represents a predictive tool for future inter and intra-arch harmony in permanent dentition.

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