

Surgical Procedures and Clinical Considerations for Impacted Canines: A Literature Review

Parviz Torkzaban,¹ and Ramin Rad^{2,*}

¹Department of Periodontology, Hamedan University of Medical Sciences, Hamedan, IR Iran

²Faculty of Medicine, Hamedan University of Medical Sciences, Hamedan, IR Iran

*Corresponding author: Ramin Rad, Faculty of Medicine, Hamedan University of Medical Sciences, Hamedan, IR Iran. Tel: +98-9387330424, E-mail: raminrad.r21370@yahoo.com

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Abstract

Impaction of canine teeth is a clinical problem whose treatment usually requires an interdisciplinary approach. After the maxillary third molar, the maxillary canine is the second-most commonly impacted tooth, with an incidence of 1% - 2.5%. Maxillary canines are more common in females than males. This study reviews the surgical treatments and orthodontic considerations for impacted canines exposure reported in previous studies. The clinician should be aware of variations in the surgical management of labially and palatally impacted canines, as well as the most common methods of canine in orthodontic application, and the implications of canine extraction. The different factors that affect these decisions are discussed.

Keywords: Surgical Procedures, Operative, Tooth, Impacted, Review Literature as Topic

1. Context

Impacted teeth, especially canines, can lead to many problems in orthodontic treatment (1, 2). They often prolong orthodontic actions and esthetic results, and, in some cases, place pressure on adjacent roots. An estimated 0.71% of 10-13 years old children have permanent incisors with roots under pressure caused by the eruption of maxillary canines (3, 4). Approximately 80% of root-resorpted teeth are lateral incisors (5, 6). After impacted teeth are completely positioned, and orthodontic actions are completed, root resorption must be stopped, and the tooth should remain functional. Appropriate exposure of impacted canines is necessary for complete orthodontic treatment. Maxillary canines are most frequently palatally impacted at a proportion of 3:1 (7), which can place them in a horizontal position that makes treatment more complex (8-11). In addition, a preliminary study supports that a corticotomy-assisted surgical technique reduces orthodontic treatment time for palatally impacted canines (12). This study reviews the surgical treatment and orthodontic considerations in the management of impacted canines and discusses methods used to identify impacted teeth.

1.1. Etiology

The main causes of maxillary canine displacement include: 1) lack of space; 2) disturbances in the tooth eruption sequence; 3) trauma; 4) ankylosis; 5) retention of primary canines; 6) cystic or neoplastic formation; 7) premature root closure; 8) abnormal positioning of tooth buds;

and 9) localized pathological lesions (e.g., cysts, odontoma) (5, 13-17).

Moyers et al. (18) describes prolonged development of the path of the maxillary canine: "The maxillary cuspid have a complex path of effusion than other tooth. The maxilla is high at three years old, with its crown directed mesially and little lingually. It moves to the occlusal plane, inchmeal up-righting itself until it seems to strike the distal part of the lateral incisor root."

1.2. Impacted Canines Diagnosis

1.2.1. Clinical Diagnosis

Clinical assessment is performed by palpating the canine bulge above the primary canine. Clinical signs of canine impaction include: 1) retention of the primary canine after age 14 or 15 years; 2) lack of a normal labial canine bulge; 3) asymmetrical canine bulge; 4) presence of a palatal bulge; 5) late eruption; 6) distal tipping; and 7) movement of the lateral incisor (5).

1.2.1.1. Localization of the Maxillary Canine

1.2.1.1.1. Clinical Evaluation

Based on Ericson and Kurol (3), the absence of the canine bulge in earlier ages should not be considered to be indicative of canine impaction. In a study of 505 schoolchildren of ages, Ericson and Kurol found that 29% had non-palpable canines at 10 years old, but only 5% at 11 years old, and only 3% at later ages (3). Therefore, for an accurate diagnosis, the clinical examination should be supplemented with radiographic evaluation.

1.2.2. Radiographic Assessment

Accurate localization of the unerupted maxillary canine plays a critical role. It can help detect tooth displacement in mixed dentition and prevent subsequent impaction. It also helps determine the feasibility and proper access for the surgical approach and the appropriate direction for the application of orthodontic force. Various radiographic exposures, including panoramic views, periapical view, occlusal films, posteroanterior views, and lateral cephalogram, can help to evaluate the position of the canines. However, all these techniques visualize teeth in two dimensions. Consequently, three-dimensional (3D) radiographic techniques, including computed tomography (CT), spiral CT, and cone beam computed tomography (CBCT), were introduced (19).

1.2.2.1. Radiographic Evaluation

Radiographic assessment must be used alongside clinical assessment. When the position of a tooth cannot be detected clinically, radiographic diagnosis following the buccal object rule should be used to identify the precise position of an impacted tooth. The buccal object rule is a method for determining the relative location of objects hidden in the oral region. The rule holds that, when two separate radiographs are made of a pair of objects, the image of the buccal object moves in the same direction that the x-ray beam is directed. The concept of this procedure was first reported in 1952 and 1953 and since then has been developed to its present state of refinement and usefulness (1, 20). As well, in 2009, Kau et al. (21) reported a novel 3D classification system for canine impactions. In this method, 3D cone beam imaging uses spatial relations to localize impacted canines, with excellent tissue contrast. This method employs all three views of a CBCT image (21).

1.3. Surgical Procedures

1.3.1. Pre-surgical Orthodontic Treatment

An entire maxillary arch should be bracketed for the impacted maxillary canine to permit appropriate positioning of the canine (22). Dividing the entire arch will prepare sufficient anchorage for extrusion of the impacted canine (22).

Another option is to use a micro-implant or mini-implant as an anchor to push the impacted canine (23). A mini-implant can provide proper pressure to locate the canine for forced eruption, and implants can be removed easily after the treatment period. However, before any surgical intervention, sufficient space should be formed to simplify the movement of the impacted tooth.

1.3.2. Gingivectomy

This technique can be used with facial canine impactions if the tip of the canine cusp is placed coronal to the cemento enamel junction (CEJ) of the adjacent lateral incisor. A sufficient amount of keratinized gingiva (KG) is needed so that at least 3 mm of KG remains after gingivectomy (5, 22, 24). This method can be performed with a Kirkland gingivectomy knife or a round diamond bur. Half to two-thirds of the crown should be uncovered to allow stable bracketing (5, 22, 24). The tooth should start moving approximately 2-3 weeks after exposure (22). The advantages of this technique are its simplicity and minimal degree of trauma, but it can be used in only a few cases and can damage the attachment apparatus (25, 26).

1.3.3. Apically Positioned Flap

An apically positioned flap (APF) can be used for labial canine impactions. Normally, at least 3mm of KG is considered to be physiologically sufficient (Figure 1). If sufficient attached tissue cannot be kept after gingivectomy, the APF technique must be used (26). In APF, an incision is made on the crest of the edentulous ridge to preserve as much KG as possible (25). Then, the incision is extended vertically into the vestibule, raising a split-thickness flap. A thin, bony cap might cover the tooth. This bony cap can be picked up with a round bur. Approximately two-thirds of the crown must be exposed, and the dental follicle must be omitted by a curette (22).

Orthodontic treatment should be started after 2-3 weeks. A pedicle flap from another part might be required because the canine impaction is lateral to the edentulous part. Kokich et al. (22) suggested that, in these cases, at least 6 mm of KG must be present initially. Inappropriate controlling of buccal canine impactions could result in gingival inflammation, mucogingival recession, and loss of the alveolar bone (26-28). APF is the most common procedure for facial impactions (29) but, like other techniques, has some disadvantages, including greater risk of recession and uneven gingival margins. In addition, labial bone frequently needs removal. A greater risk arise in impactions close to nasal spine, where exposure relapses are common (7).

1.4. Closed Technique

If impacted canines are apically located in the vestibule, adjacent to the nasal spine, or in the middle of the alveolar bone, the closed eruption technique is the most useful procedure (30-33). APF is impossible in these situations because it requires removing enough bone to expose the crown. Therefore, a closed approach is a better choice. In closed technique procedures, a flap is raised via

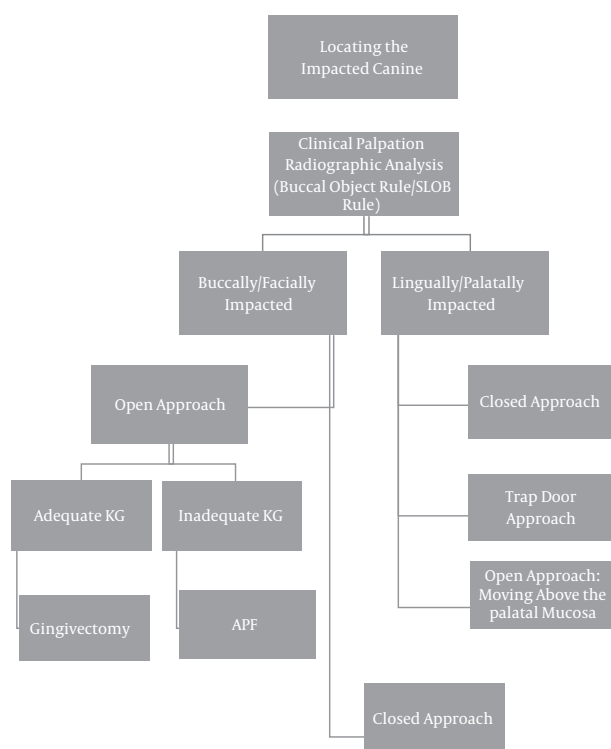


Figure 1. Decision Tree to Choose the Appropriate Technique for an Impacted Canine

a crestal incision, and adequate bone is removed adjacent to the tooth so that a bracket or eyelet can be placed during surgery (22, 29).

In 2005, Chaushu et al. (34) studied perceptions of immediate postoperative recovery after surgical exposure of impacted teeth treated with a closed- or open -technique. The researchers concluded that the immediate postoperative recovery was longer and more substantially impaired after open compared with closed surgery.(34).

The advantages of the closed technique are that it normally produces the finest gingival esthetics and facilitates tooth movement (22, 26, 29). The disadvantages of this technique include more reported discomfort after surgery and the need for second surgery in case of bracket detachment. Also, in the case of improper orthodontic mechanics, mucogingival problems can arise and cause the tooth to erupt through the mucosa (22, 26, 35).

The most difficult impacted canines to treat are teeth which are located horizontally to the lateral and central incisors, high in the roof of the mouth (22). The best surgical technique for this situation is the closed flap technique. The bone around the impacted teeth will be removed by a curette or a round bur . After the isolation the bracket will be bonded on the tooth and the flap will be returned to its

original position (7).

1.5. Open Trap-Door Technique

In the open trap-door technique, a thick flap is raised, as in the closed technique, and the tooth with the bracket/eyelet is palpated via the flap (7). The zone is then fenestrated with a blade or round bur to build a pore (the trap door) to expose the bracket through the flap. The flap is then sutured, and a gold chain or wire is attached from the bracket/eyelet to the arch through the flap. Orthodontic pressure is started after 1 - 2 weeks (22).

2. Conclusions

In the case of canine impactions, a clear diagnosis is the most important factor to achieve successful surgical treatment. Appropriate radiographic and clinical diagnosis could help dentists determine whether a canine is impacted palatally or facially. Next, the best surgical treatment can be decided based on the techniques discussed in this paper.

Footnote

Authors' Contribution: Parviz Torkzaban: concept and idea development; Ramin Rad: writing, editing, submission, and revision of the manuscript.

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