

Surgical and orthodontic management of impacted maxillary canines

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Although the mechanical management of impacted teeth is a routine task for most orthodontists, certain impactions can be frustrating, and the esthetic outcome can be unpredictable if the surgeon uncovers the impacted tooth improperly. When referring a patient to have an impacted tooth uncovered, the orthodontist might assume in-

correctly that the surgeon knows which surgical procedure to use. However, if not instructed properly, the surgeon could select an inappropriate technique, leaving the orthodontist with the difficult if not sometimes lengthy and challenging task of erupting the impacted tooth into the dental arch. On the other hand, if the correct uncovering technique is chosen, the eruption process can be simplified, resulting in a predictably stable and esthetic result. This is especially true for impacted maxillary canines. After the third molars, the maxillary canines are the most commonly impacted permanent teeth.¹ About one third of impacted maxillary canines are positioned labially or within the alveolus, and two thirds are located palatally.² In most situations, the appropriate timing and surgical procedure for uncovering an impacted canine are determined by specific criteria. This article will review the surgical and orthodontic management of impacted maxillary canines.

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Labial impaction

Labial impaction of a maxillary canine is due either to ectopic migration of the canine crown over the root of the lateral incisor or shifting of the maxillary dental midline, causing insufficient space for the canine to erupt. Williams³ suggested that extraction of the maxillary deciduous canine as early as 8 or 9 years of age will enhance the eruption and self-correction of a labial or intra-alveolar maxillary canine impaction. Olive⁴ suggested that opening space for the canine crown with routine orthodontic mechanics might allow for spontaneous eruption of an impacted canine. However, in some situations, even these techniques do not work, and the orthodontist must refer the patient to have the labial impaction uncovered surgically. There are 3 techniques for uncovering a labially impacted maxillary canine: excisional uncovering (Fig 1), apically positioned flap⁵ (Figs 2 and 3), and closed eruption techniques⁶ (Fig 4). Which technique should the orthodontist recommend?

When referring a patient for surgical exposure of a labial or intra-alveolar impaction of a maxillary canine, the orthodontist should evaluate 4 criteria to determine the correct method for uncovering the tooth. First, assess the labiolingual position of the impacted canine crown. If the tooth is impacted labially, then any of the 3 techniques could be used, because generally there is little if any bone covering the crown of the impacted canine. However, if the tooth is impacted in the center of the alveolus, an excisional approach and an apically positioned flap are generally more difficult to perform, because extensive bone might need to be removed from the labial surface of the crown. The second criterion to evaluate is the vertical position of the tooth relative to the mucogingival junction. If most of the canine crown is positioned coronal to the mucogingival junction (Fig 1), any of the 3 techniques can be used to uncover the tooth. However, if the canine crown were positioned apical to the mucogingival junction (Figs 2 and 3), an excisional technique would be inappropriate, because it would not result in any gingiva over the labial surface of the tooth after it had erupted. In addition, if the crown were positioned significantly apical to the mucogingival junction (Fig 4), an apically positioned flap

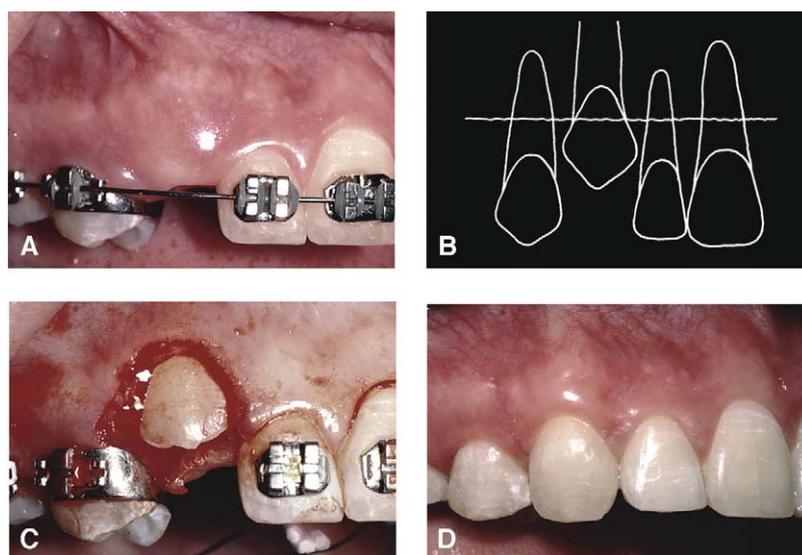


Fig 1. Patient had impacted maxillary right canine. **A**, Space was created orthodontically, but tooth did not erupt. **B**, Tooth was labially positioned, coronal to mucogingival junction, and there was sufficient gingiva in area. **C**, simple excisional procedure was used to uncover it. **D**, After orthodontic eruption, relationship of gingival margins relative to adjacent teeth was normal with adequate zone of gingiva.

would also be inappropriate, because it would result in instability of the crown and possible reintrusion of the tooth after orthodontic treatment.⁷ In the latter situation, a closed eruption technique will provide adequate gingiva over the crown and does not result in reintrusion of the tooth in the long term.⁸

The third criterion to evaluate is the amount of gingiva in the area of the impacted canine. If there were insufficient gingiva in the area of the canine (Fig 3), the only technique that predictably would produce more gingiva is an apically positioned flap. However, if there were sufficient gingiva to provide at least 2 to 3 mm of attached gingiva over the canine crown after it had been erupted, any of the 3 techniques could be used. The fourth and final criterion to evaluate is the mesiodistal position of the canine crown. If the crown were positioned mesially and over the root of the lateral incisor (Fig 2), it could be difficult to move the tooth through the alveolus unless it was completely exposed with an apically positioned flap. In this latter situation, closed eruption or excisional uncovering generally would not be recommended.

Orthodontic mechanics and long-term stability

The mechanics to erupt a labially impacted tooth should mimic the normal eruptive process. If the canine crown were uncovered with a closed-eruption technique (Fig 4), the orthodontist should select mechanics that erupt the tooth into the center of the

alveolar ridge. This method would produce normal labial gingival relationships over the erupted tooth. The orthodontist should avoid mechanics that draw the tooth labially, which could produce a bony dehiscence and accelerated migration of the labial gingival margin, resulting in labial recession. A ballista loop (Fig 4) is a simple, convenient, unobtrusive method of applying a vertical vector of force to a labially impacted tooth to erupt the crown into the center of the alveolus. When the canine crown is displaced mesially and lies over the root of the permanent lateral incisor (Fig 2), an apically positioned flap is the appropriate surgical uncovering technique. Exposure of the crown facilitates attachment of an elastomeric chain (Fig 2) directed toward the center of the edentulous alveolar ridge to gradually guide the canine crown into the dental arch.

Vermette et al⁷ compared the periodontal and esthetic result after closed eruption and apically positioned flap techniques. They found no significant differences in gingival index, plaque index, pocket depth, and bone level between these 2 techniques, but they identified significant esthetic differences. With an apically positioned flap, the crown length of the impacted tooth is longer than normal, due to apical migration of the gingival margin. The crown lengths of teeth uncovered with closed eruption were similar to contralateral nonimpacted teeth in the same mouth. Second, and perhaps more disturbing, high labial impactions uncov-

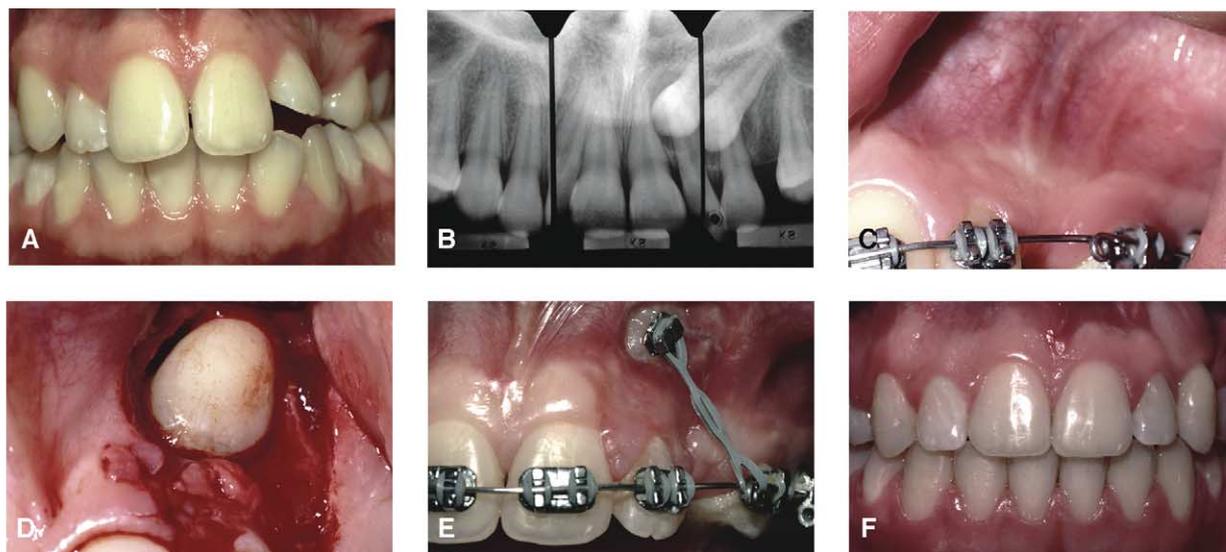


Fig 2. **A**, Patient had impacted maxillary left canine. **B**, Buccal object rule indicated tooth was positioned labially. **C**, Teeth were initially aligned, and, because canine crown was positioned labially, any of 3 uncovering techniques could be used. However, cusp tip was positioned above mucogingival junction and was displaced mesially. **D**, Apically positioned flap technique was chosen. **E**, After gingival tissues had healed, tooth was gradually moved distally. **F**, Placed in its correct position.

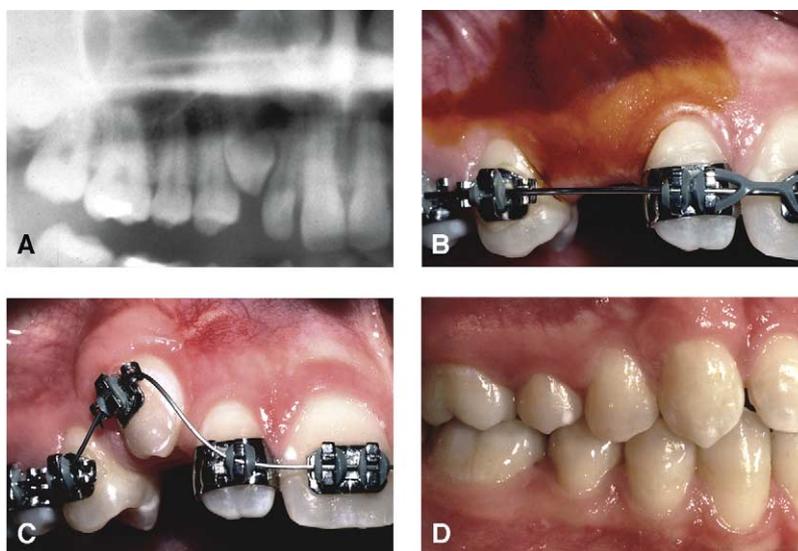


Fig 3. **A**, Patient had impacted maxillary right canine. Crown was positioned labially between lateral and first premolar and was partially below mucogingival junction. Simple excisional uncovering could not be used, because there was insufficient gingiva in region. **B**, Mucosa stained with Schiller's iodine solution. Apically positioned flap was used to expose tooth and increase width of gingiva. **C**, After healing, bracket was attached. **D**, Tooth erupted into position with adequate zone of gingiva.

ered with an apically positioned flap tend to reintrude after orthodontic treatment. This is due to the healing of the apically positioned flap to the mucosa adjacent to

the impacted tooth at the time of uncovering. As the tooth is erupted into the dental arch, the mucosa is drawn coronally. After orthodontic treatment, this mu-

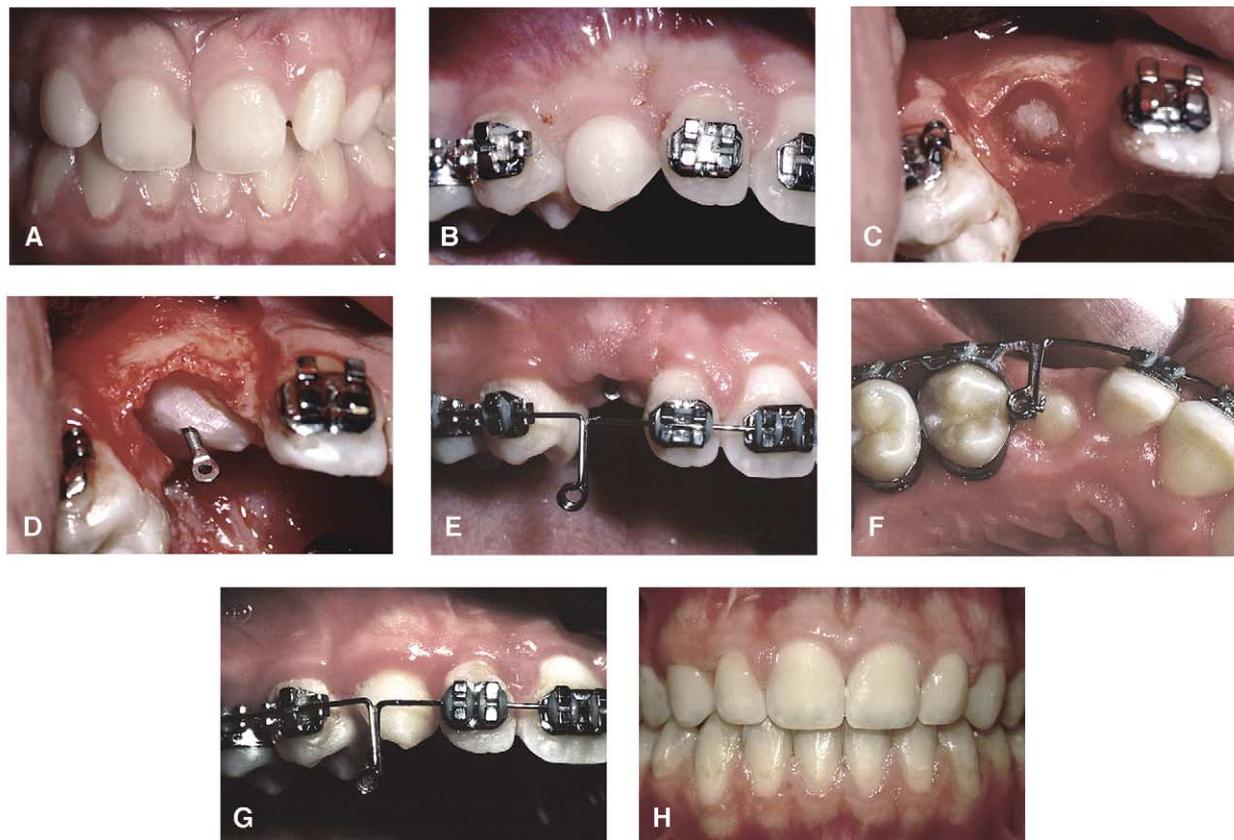


Fig 4. **A**, Patient had intra-alveolar impaction of maxillary right canine. **B**, Space was opened orthodontically for impacted tooth. Crown was positioned above mucogingival junction and in alveolus, so neither excisional uncovering nor apically positioned flap was appropriate. **C**, Closed eruption technique was used. **D**, Labial flap was elevated, and sufficient bone around crown was removed to allow eruption without impinging on bone. **E**, **F**, and **G**, Ballista loop was used to erupt tooth into center of alveolar ridge. Canine was then placed in its proper position in arch. **H**, After orthodontic treatment, right canine has sufficient gingiva and resembles contralateral nonimpacted canine.

cosal attachment tends to pull the crown of the tooth apically. This disadvantage was not observed in teeth uncovered with closed eruption. Becker et al⁸ found similar favorable esthetic results in their study of the closed eruption technique for uncovering impacted maxillary central incisors.

Radiographic verification of crown position

While evaluating the position of the impacted canine, the orthodontist must assess radiographs to determine the accurate position of the crown. The orthodontist must rely on the buccal object rule⁹ to identify the exact labiolingual position of the crown. The buccal object rule states that when viewing 2 adjacent periapical radiographs of the impacted tooth taken at slightly different horizontal angles, the buccal object will move in the opposite direction of the x-ray

beam. If the impacted canine were located palatally, the crown of the tooth would move in the same direction as the x-ray beam. A mnemonic method for remembering this principle is the S.L.O.B. rule (same lingual opposite buccal).

Palatal impaction

The most common impaction encountered by orthodontists is the palatal impaction of maxillary canines.² However, Ericson and Kurol¹⁰ showed that early extraction of deciduous maxillary canines will result in normal eruption of ectopically displaced permanent maxillary canines. In their extensive study, they found that, if periapical radiographs showed that the crown of the permanent canine were positioned over the root of the maxillary lateral incisor, but not past the mesial surface of the root, self-correction of the ectopic canine

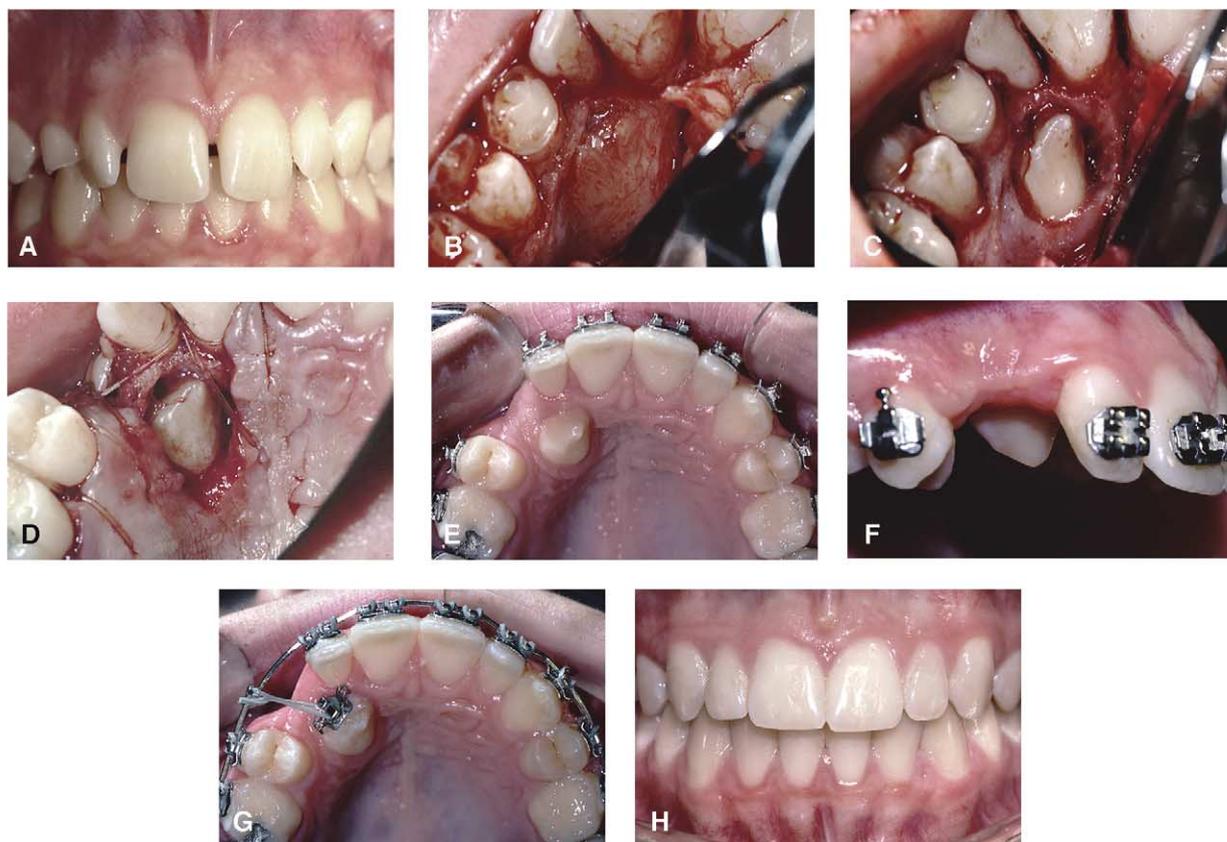


Fig 5. **A**, Patient had palatally impacted maxillary right canine. To permit impacted canine to erupt autonomously and reduce time in orthodontic appliances, impacted tooth was uncovered before orthodontic treatment. **B**, Mucoperiosteal flap was elevated, and it was determined that crown was still covered with bone. **C**, All palatal bone down to cemento-enamel junction was removed so that tooth could erupt unimpeded. **D**, Hole was placed in flap, and it was repositioned and sutured over crown of impacted canine. **E** and **F**, Canine erupted without orthodontic forces. **G**, When cusp tip was at level of occlusal plane, bracket was placed on crown and root was moved labially. **H**, After orthodontic treatment, it is difficult to identify differences between previously impacted right canine and contralateral nonimpacted canine.

occurred with high predictability if the deciduous canine were removed. However, if the permanent canine were positioned well beyond the mesial surface of the lateral incisor root, self-correction does not occur with extraction of the deciduous canine. The palatally impacted canine must be uncovered by a surgeon and positioned in the dental arch by the orthodontist.

If not uncovered properly, palatally impacted canines can be the most frustrating impactions for the orthodontist to resolve. For most orthodontists, uncovering a palatally impacted canine occurs after the first 6 to 9 months of orthodontic alignment of the maxillary dentition. Space is created for the crown of the impacted tooth, and the patient is referred to a surgeon to uncover the crown. Usually, soon after the surgery, the orthodontist begins dragging the crown toward the

edentulous site. However, the crown of a palatally impacted canine is often in intimate contact with the lingual surfaces of the roots of the ipsilateral central and lateral incisors. If the tooth was not uncovered properly, it could appear to the orthodontist that the tooth is not moving and perhaps could be ankylosed. The incidence of ankylosed maxillary canines is low.¹¹ The problem in these situations is insufficient bone removal over the crown of the impacted canine. If this occurs, after the dental follicle is deflated and removed, the tooth cannot resorb the bone over the crown efficiently. When a force is placed on the tooth and the enamel of the impacted crown comes into contact with the bone, there are no cells in the enamel to resorb the bone. Resorption will eventually occur through pressure necrosis, but it will occur slowly.

Woloshyn et al¹² evaluated 32 patients who had palatally impacted canines that were uncovered in this manner and then dragged into the dental arch across the lingual surface of the lateral incisor roots. These authors found that the bone levels on the distal surface of the lateral incisor and mesial surface of the canine were positioned more apically compared with the contralateral nonimpacted control teeth. In addition, root resorption of the lateral incisor and the canine were typical when the canine was erupted in this manner. Finally, after orthodontic treatment, judges could identify which canine had been palatally impacted because the appearance of the tissue around the previously impacted canine compared favorably with that of the contralateral nonimpacted tooth.

Kokich and Mathews¹¹ recommend an alternative technique with earlier timing for uncovering palatally impacted canines. They time the uncovering of palatal canines before the start of orthodontic treatment. In some cases, these teeth are uncovered during the late mixed dentition. In these situations, a full-thickness mucoperiosteal flap is elevated in the area of the impacted canine (Fig 5). All bone over the crown is removed down to the cemento-enamel junction. The flap is repositioned, and a hole is made through the gingival flap (Fig 5). Occasionally, if the tooth is positioned high in the palate, a dressing is placed over the exposed area in the flap. Once the bone and tissue have been removed, these palatally displaced canines will erupt on their own (Fig 5). In about 6 to 8 months, the canines generally have erupted to the level of the occlusal plane. At that point, a bracket can be placed on the tooth, and the root can be moved through the bone as the crown is gradually translated into the dental arch.

A recent study by Schmidt¹³ has shown that not only are the bone levels and attachment levels improved on the canine and lateral incisor with this technique, but also little to no root resorption occurs on the lateral incisors. In addition, after orthodontic treatment, it is difficult to determine which canine was previously impacted, because the gingival tissue on the impacted tooth matches that of the contralateral non-

impacted canine. It seems appropriate to uncover palatally impacted canines early, during the mixed dentition, so that they can erupt autonomously, without orthodontic intervention, until the crown has erupted to the level of the occlusal plane. At that time, it can be moved more efficiently into the dental arch. By treating palatally impacted canines in this manner, the overall treatment time for the patient is reduced, and the periodontal and esthetic results are superior compared with previous methods for exposing palatally impacted canines.

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