The Palatally Impacted Canine, Preorthodontic Uncovering Technique, and Spontaneous Eruption: A Case Series

Maxillary canines are the second most commonly impacted teeth, with mandibular third molars being the most commonly impacted teeth. One-third of the impacted maxillary canines are labially impacted, and the remaining two-thirds are palatally impacted. Palatally impacted canines (PICs) comprise approximately 1% to 2.5% of the general population. These impactions can be managed with preventive, interceptive techniques or surgical uncovering. If preventive or interceptive measures are unsuccessful in allowing the canine to erupt, there are many techniques that can be employed to uncover the PIC. Canines that are very superficially impacted can be uncovered with a simple gingivectomy. Canines that are more deeply impacted will require flap reflection, bone removal, and the placement of some type of orthodontic bracket. Most often, the surgeon will attach a chain to the impacted tooth so the orthodontist can immediately begin movement with some form of traction device. The preorthodontic uncovering technique (POUT) allows spontaneous eruption of the impacted tooth without active orthodontic force. When this technique is employed early (approximately 6 months before orthodontic treatment is initiated), it will save considerable time and trauma in erupting these teeth. Research has shown that this technique decreases orthodontic treatment time to properly position these teeth. In addition, this technique has been shown to be healthier for the bone and root structure of the impacted tooth and surrounding teeth. This article elucidates the benefits of the POUT when uncovering simple and very complicated PICs.


Maxillary palatally impacted canines (PICs) comprise 1% to 2.5% of the population. It is conjectured that ectopic displacement of the canine, lingual to the lateral incisor, prevents the expanding follicle from being able to penetrate the thick palatal bone and palatal tissue. Early diagnosis of the PIC will help clinicians employ preventive and interceptive measures, such as extraction of the deciduous canine and expansion techniques, to obviate the need for future treatment to uncover these teeth.1–7 Early diagnosis will also minimize the risk to adjacent teeth becoming damaged if the tooth erupts in an aberrant pathway8–10 (Fig 1).

If these preventive and interceptive measures are not employed or are unsuccessful, surgical uncovering of the PIC will be necessary if it is to be included in the orthodontic treatment plan. There are situations where the PIC is so badly impacted that extraction may be the treatment of choice. This is usually in Class II malocclusions, in which the extraction of a tooth or teeth is necessary for treatment. In addition, there are PICs that become “ankylosed” as the patient ages. Because these teeth do not have a periodontal ligament, movement will be very difficult.

Surgical techniques to uncover the PIC include gingivectomy, flap
uncovering with a closed technique, flap uncovering leaving the PIC uncovered and attaching a chain, and flap uncovering leaving the PIC uncovered and placing a barrier on the tooth so it can erupt spontaneously.

This article will discuss a series of cases showing surgical uncovering of the PIC and placement of a barrier to allow the tooth to spontaneously erupt without any orthodontic traction, known as the pre-orthodontic uncovering technique (POUT). Once the tooth has erupted considerably, the orthodontist can apply traction and move it easily into position. The advantages of this technique are elucidated within the PIC cases, which range from very simple to very complicated.

Materials and Methods

Generally, the optimum time to uncover the PIC is 6 months prior to beginning orthodontic treatment. However, every type of malocclusion has a different “start” time based on the mixed dentition and other factors. Timing the surgical uncovering is important to allow the PIC to spontaneously erupt to a favorable position where orthodontic traction will easily move the tooth without any damage to the PIC and adjacent teeth and bone, and to allow proper and timely treatment. Occasionally, there are severe PICs that can cause damage to adjacent teeth as they erupt. These PICs need to be uncovered even earlier to prevent resorption of the adjacent roots (Fig 1).

There are a few PICs that are very superficially positioned and are not covered with bone (Type 1; Fig 2). These can be accessed with a gingivectomy or a laser, and they will erupt spontaneously without any orthodontic traction. The tooth can then be moved easily into position. Most PICs are imbedded 1 to 3 mm below the surface of the bone (Type 2; Figs 3 and 4) and will require flap reflection and bone removal to allow for spontaneous eruption. A few PICs are very deeply imbedded (5 to 7 mm) under the surface of the bone (Type 3; Fig 5).

When the PIC is uncovered, a dressing is placed to prevent tissues from healing over the tooth,
Fig 3 Case 2. (a) The palatally impacted canine is covered with a thin shell of bone (Type 2). A full-thickness flap is reflected from the midline to the second premolar, and a 3-mm collar of tissue is left around the central and lateral incisors. (b) The thin shell of bone is easily removed with a curette, exposing a wide margin to allow spontaneous eruption. The follicle is left intact to minimize bleeding. (c) The tooth is etched, and a cleat (a bracket with a semicircular attachment) is bonded to the PIC. The palatal flap is scalloped, and a light-cured dressing is attached to the cleat. The deciduous canine is extracted, and the flap is secured with a resorbable gut suture. (d) Four months later, the PIC erupted spontaneously, approximately 10 mm. It is now in an ideal location for the orthodontist to place brackets and move it easily into position in a few months. (e) After orthodontic appliances were placed, the PIC was moved into an ideal position, and proper “finishing” was completed. The bone levels and root length were commensurate with the contralateral non-impacted canine and lateral incisor.

Fig 4 Case 3. (a) Periapical radiographs showing both right and left moderately impacted canines (Type 2). The buccal object rule was used to diagnose the palatal position. (b) Both PICs were uncovered with separate full-thickness flaps, preserving the anterior palatine foramen. The thin shell of bone was removed, the teeth were isolated, cleats (brackets with a semicircular attachment) were bonded to the teeth, and a dressing was placed. (c) The teeth were allowed to erupt over the next 8 months. The peg-shaped lateral incisors were bonded, appropriate space was created, and the orthodontist began moving the canines into an ideal position. (d) A lateral view shows that the PICs erupted spontaneously (approximately 10 mm), facilitating easy orthodontic finishing. (e) The case is completed to an ideal Class I occlusion.
Once the tooth has erupted above the surface of the palatal tissue, the dressing can be removed. The PIC will spontaneously erupt over the next 1 to 3 months, depending on the initial impaction depth. In cases that are superficially impacted (Types 1 and 2), this will take 3 to 4 weeks. In extremely deep impactions (Type 3), it will take 3 to 4 months before the tooth erupts above the palatal tissue level.

The more the PIC is allowed to spontaneously erupt, the easier it will be for the orthodontist to move it into position, with less trauma to the patient and surrounding structures. Interestingly, these PICs will erupt distally, away from the maxillary incisors. Optimally, these teeth have been shown to erupt approximately 10 mm vertically to the occlusal plane level. This makes it very easy for the orthodontist to walk the tooth into place. The periodontal ligament (PDL) on the root is the resorptive mechanism that allows for easy tooth movement. If the orthodontist attempts to drag a PIC out of the palate with an A-elastic soon after uncovering, the enamel is forced into the bone. This is a slower resorption process than the PDL, which causes physiologic resorption as the tooth moves through the bone. In addition, this improper force vector can tip the root of the PIC and can cause a significant dehiscence on the lingual aspect of the PIC.

Case Reports

Case 1

An adolescent female patient presented with an impacted canine, with the palatal position diagnosed with periapical radiographs (Figs 2a and 2b). Using the buccal object rule (Clark’s rule), it was evident that the canine was palatally positioned. In addition, a slight palatal bump was seen, which indicated that the tooth was superficially impacted.
Prior to orthodontic treatment, the tooth was uncovered with an excisional gingivectomy (Fig 2c). The entire crown was evident, and no bone removal was necessary. A light-cured dressing (Barriac, Dentsply Sirona) was placed to ensure that the tissue would not re-cover the tooth as it healed. The dressing was removed 3 weeks later, and the tooth had already erupted above the surface of the palatal tissue.

Orthodontic treatment was initiated 6 months later, and the teeth were aligned to make space for the erupted canine. The canine continued to erupt significantly (Fig 2d) and was bracketed and easily moved into position. Orthodontic finishing was completed. The gingival levels, esthetics (color), root length, and bone levels were commensurate with the nonimpacted contralateral canine (Fig 2e).

Case 2

An adolescent patient presented with an impacted canine, diagnosed with two periapical radiographs that showed a clear palatal location, mesial to the lateral incisor. The radiographs also showed that the tooth was more deeply imbedded (Type 2). The patient was a “late” referral to the orthodontist, and no preventive or interceptive measures had been done. Prior to initiating orthodontic treatment, the patient was referred to a periodontist to uncover the PIC.

The PIC was moderately im- pactcd below the surface of a thin sheet of palatal bone (Type 2). When a PIC is covered with bone, removing the thin bone shell is easiest when a flap is reflected: An incision is made from the midline, extending posteriorly to the second premolar, and leaving a 2- to 3-mm collar of tissue around the maxillary incisors (Fig 3a). If the deciduous canine is still present in these cases, it is usually extracted during uncovering. However, patients occasionally request that the tooth be left for esthetic reasons, and it can be extracted at a later time (decided by the orthodontist).

The very thin shell of bone cov- ering the impacted tooth can be easily removed with a curette. The impacted tooth should be exposed enough so the access hole is wider than the periphery of the tooth to allow easy spontaneous eruption (Fig 3b). The follicle surrounding the crown periphery of the PIC was left untouched, as excessive curetting and removal of the follicle increases bleeding, which will make it more difficult to bond a bracket to the PIC. The tooth was then isolated and cleaned for etching. A bonding agent was painted over the surface, and a “cleat” was attached with a bonding cement, then light cured. The cleat, which is a bracket with a semicircular attachment, is best for retaining the dressing, as com- pared to a bracket. If there is bleeding around the periphery, pledgets (such as Hemodent, Premier; as used herein) can be placed to keep the area dry to ensure successful bonding. The flap was then scal- loped slightly to leave the periphery of the PIC exposed so that the dressing could be placed and light cured (Fig 3c). Four months later, the PIC spontaneously erupted considerably and moved distally from the adjacent central and lateral incisors (Fig 3d). Orthodontic treatment was initiated, the canine was easily moved into position, and the case was completed (Fig 3e).

Case 3

An adolescent boy presented with a Class I malocclusion, with both maxillary canines impacted. Using the buccal object rule, it was determined that the canines were palatally positioned (Fig 4a). In addition, the patient had considerable crowding and peg-shaped maxillary lateral incisors. All of the teeth had mild to moderate fluorosis. He had a very favorable profile, so a non-extraction treatment plan was indicated. The orthodontist referred the patient to a periodontist to uncover both canines and allow them to erupt prior to placement of orthodontic appliances.

The canines were uncovered with separate palatal flaps, leaving a collar of tissue around the lateral and central incisors and preserving the anterior palatine foramen. Both canines were completely covered with bone. The bone was care- fully removed, exposing both teeth so the access was wider than the periphery of the teeth (Fig 4b). A dressing was placed, and the teeth erupted above the surface of the palatal tissue in 4 weeks. The dressing was removed, and the teeth were allowed to erupt for another 8
months. At that point, orthodontic treatment was initiated. The peg-shaped lateral incisors were built up, appliances were placed, and space was created for the canines (Fig 4c). The right canine had autonomously erupted 10 mm prior to active orthodontic movement (Fig 4d). Orthodontic treatment was completed with an ideal Class I relationship, and the gingival levels were ideal for both canines (Fig 4e).

Case 4
An adolescent girl presented with a palatally impacted canine, diagnosed with two periapical radiographs. The impacted canine was very deeply imbedded near the apices of the central and lateral incisors. In addition, the patient had short tapering roots (Fig 5a). The orthodontist referred the patient to a periodontist to uncover the impacted canine and allow it to erupt spontaneously prior to initiating orthodontic treatment.

A full-thickness palatal flap was elevated from the midline to the mesial aspect of the first molar, and a 3-mm gingival collar was left around the central and lateral incisors. The patient requested that the deciduous canine be left for esthetic reasons; it would be extracted later in treatment as the impacted canine erupted, and the orthodontist would begin moving it into position. After judicious bone removal, the canine was located. The tooth was approximately 10 mm apical to the surface of the palatal tissue (Fig 5b). A cleat (Fig 5b) was bonded and light cured to the tooth to help retain the dressing (Barricaid), which was placed in two pieces. The first piece was bonded prior to flap suturing. The flap was then fenestrated over the impacted tooth and dressing, and it was sutured with resorbable gut sutures. The remaining 5 mm of dressing was added to the previous material and brought to the surface of the sutured palatal tissue (Fig 5c).

The PIC was allowed to erupt over a 5-month time period. The patient was extremely cooperative and kept the dressing clean with gentle swabbing with chlorhexidine. When the tooth erupted above the palatal surface, the dressing was removed (Fig 5d). The tooth continued to spontaneously erupt, and the orthodontist placed an appropriate bracket on the canine, removed the deciduous canine, and moved the permanent canine easily into position. The clinical situation at the 6-year follow-up attests to the stability and periodontal health of the previously impacted canine (Fig 5e).

Discussion
Early uncovering and spontaneous eruption of PICs has been shown to reduce orthodontic treatment time, improve esthetics of the PIC when compared to the non-impacted canine, and improve periodontal support (bone and root length) of the PIC and adjacent lateral incisor and premolar.12–16 PICs uncovered with the “closed eruption” technique that are moved laterally through the bone have been shown to have more bone loss and shorter roots. In addition, the “closed eruption” technique, being more traumatic, has been shown to have a higher incidence of pulpal pathology and color changes when compared to the contralateral non-impacted canine.17–19 When pain levels were evaluated, there was no difference between the closed and open techniques.20 Long-term stability of the PIC was better with the open technique, and there was more intrusion of the PIC with the closed technique.21 The POUT requires no fixed or removable appliance when employed with the mixed dentition. It also prevents resorption of adjacent roots, as the uncovered PIC will erupt to the center of the palate, away from the central and lateral incisors. Reparative cellular cementum forms on the surfaces of the central and lateral roots.22

All of these cases were diagnosed with two periapical radiographs taken from different angles and using the buccal object rule. Early diagnosis of the PIC will allow clinicians to employ preventive measures, such as early extraction of the deciduous canine and expansion techniques, which give the PIC a chance to erupt on its own. If these techniques are unsuccessful, then surgical uncovering is necessary. Consultation with the orthodontist is necessary to determine whether the PIC is worth uncovering. There are a few situations where the canine is so badly impacted that uncovering is fraught with much risk to adjacent structures. In addition, movement of the tooth may be extremely difficult or even impossible, and extraction may be the
treatment of choice, pending the type of malocclusion to be treated.

In treating PICs, an ankylosed PIC has never been encountered in an adolescent. However, as patients age (25 years or older), the risk of ankylosis increases, and tooth movement may not be possible. There is no research that explains why the PDL reacts differently in these cases; perhaps long-term impaction leads to atrophy of the PDL due to disuse.23 These ankylosed canines can be diagnosed with good radiography. If there is no periodontal ligament space between the tooth and bone, one can infer that the tooth may not move. Prior to surgical intervention, a clear treatment plan should be discussed with the patient, orthodontist, and restorative clinician regarding the possibilities if the tooth is deemed “unmovable”: Will it be extracted? If so, should the area be grafted for future tooth replacement? How will it be replaced? Should it be left alone? Uncovering these teeth is extremely difficult because of the lack of any follicle around the tooth, and it is difficult to differentiate the tooth from bone during uncovering. Luxation is generally not recommended, and if the tooth is ankylosed, it will re-ankylose quickly even if it is luxated. However, very gentle luxation in these cases can aid the clinician in determining whether movement is possible. If there is no movement, the clinician should suspect that this tooth is ankylosed and will not move, and the back-up treatment plan that was discussed with the team should be enacted.

The orthodontic force vector is extremely important in moving the PIC.23–25 Teeth move through the bone because there is a PDL. Allowing the PIC to spontaneously erupt vertically simplifies this movement. The orthodontist can use simple mechanics to “walk” the tooth into position after it has spontaneously erupted (Fig 4d). Enamel will not resorb bone physiologically, and force vectors that drive the enamel into bone can cause damage to adjacent teeth and bone and prolong treatment time considerably. In addition, improper force vectors can tip the PIC and cause a dehiscence on the palatal root. Some PICs are in the middle of the alveolus, apical to the apices of the central and lateral incisors (Fig 1), and palatal access is recommended for these cases. A transpalatal archwire utilizing a distal force vector will be necessary to extricate the tooth without further damage to the apices of adjacent teeth.26 These impactions need to be treated early, before they cause resorption to the adjacent roots. Spontaneous eruption cannot be used in these cases until the tooth is extricated from underneath the apices of the adjacent teeth.

Conclusions

The preorthodontic uncovering technique for PICs has made orthodontic movement of these teeth less traumatic to the patient and adjacent bone and roots. When employed properly and in a timely manner, orthodontic treatment time to move these teeth can be shortened considerably. The lessened trauma to adjacent bone and roots decreases the risk of root resorption and bone loss around the PIC and adjacent teeth.

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References