A Minimally Invasive Approach Using a 4-mm Implant Without Extraction of Impacted Maxillary Canine: Four-Year Postloading Results

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The aim of this case report was to suggest an alternative minimally invasive surgical approach to an impacted maxillary canine using a 4-mm-long implant for a fixed prosthetic rehabilitation, avoiding tooth extraction or surgically forced extrusion and exploiting the 6 mm of coronal bone availability. At 4 years postloading, the implant was healthy and well integrated with stable marginal bone levels. The 4-mm length of the implant reduced operative times, postsurgical morbidity, possible complications, and costs. Short implants might be an alternative to traditional, more invasive surgical procedures used in the rehabilitative treatment of impacted maxillary canines. Int J Periodontics Restorative Dent 2017;37:819–824. doi: 10.11607/prd.3334

The maxillary canines are the most commonly impacted permanent teeth after the third molars. Between 25% and 50% of the general population are affected by impacted teeth, with the prevalence of maxillary canine impaction ranging from 1% to 3%. Impactions are twice as common in females (1.17%) as in males (0.51%); of all patients with maxillary impacted canines, it is estimated that 8% have bilateral impactions. The most common causes for canine impactions are the result of any one or a combination of the following factors: tooth size–arch length discrepancies, prolonged retention or early loss of the deciduous canine, ankylosis, cystic or neoplastic formations, dilacerations of the root, and idiopathic conditions with no apparent cause. Another important etiologic factor associated with canine impaction is the absence of the maxillary permanent lateral incisor, as proposed by the guidance theory. About one-third of impacted maxillary canines are positioned labially or centrally, and two-thirds are located palatally. While ectopic labially positioned canines may erupt without surgical or orthodontic treatment, palatally impacted canines seldom erupt on their own. It is believed that this impeded eruption is due to the thickness of the palatal cortical bone as well as the thick and
resistant palatal keratinized tissue. The possible consequences of canine impaction include migration of the neighboring teeth, dentigerous cyst formation, external root resorptions, infection (particularly with partial eruption), and referred pain. The preferred management of an ectopic permanent canine in a young patient is early diagnosis and interceptive treatment. The diagnosis of canine impaction is based on clinical and radiographic examinations. It has been suggested that the following clinical signs might indicate canine impaction: prolonged retention of the deciduous canine beyond 14 to 15 years of age, absence of a normal labial canine bulge or its palatal presence during intraoral palpation, and migration of the lateral incisor. A radiographic sign that might be indicative of canine impaction is the inclination of the canine from the midline observed on a panoramic radiograph: if the angle between the tooth and the midline is greater than 25 degrees, the canine is at risk of inclusion.

However, the diagnosis of an impacted canine is frequently delayed and the patient often requires surgical intervention as a part of the treatment. When the patient is an adult, the clinician should consider the following treatment options: no treatment if the patient does not desire it (in this case, the clinician should periodically evaluate the impacted tooth for any pathologic changes), extraction of the impacted canine, and surgical exposure of the canine and orthodontic treatment to bring the tooth into the line of occlusion. The latter is the most desirable approach. Unfortunately, a high frequency of failure of the orthodontic treatment has been demonstrated in adult patients. As a consequence, surgical extraction followed by implant therapy could be an alternative for adults. However, this procedure usually requires bone augmentation and might cause additional morbidity and complications. Mazor et al suggested an alternative approach to avoid impacted canine extraction by using computer-guided implant placement to provide an implant adjacent to the impacted canine without contacting it. These authors concluded that this procedure could provide a short treatment time and fewer complications compared to the extraction.

The present case report evaluated the 4-year postloading outcome of an alternative minimally invasive approach to an impacted maxillary canine using a 4-mm-long implant, exploiting the 6 mm of coronal bone available and avoiding contact with the impacted tooth.

Materials and Methods

A 54-year-old systemically healthy woman was referred for a fixed prosthetic rehabilitation of her edentulous maxillary left canine site. Preliminary clinical and radiographic (orthopantomogram) evaluations showed an edentulous left canine space due to the impaction of the left permanent canine, treated with a provisional prosthesis solution that did not suit the patient’s needs (Fig 1). The patient stated that the deciduous canine had been lost about 30 years earlier and that the permanent tooth never erupted. A cone beam computed tomography (CBCT) scan was obtained to evaluate the canine position and its relationship to neighboring teeth. The CBCT scans showed a palatal location of the impacted canine without root resorption of the lateral incisor. The mean residual bone under the impacted tooth was 6 mm in height and 7 mm in width (Fig 2).

The more traditional surgical options (extraction of the impacted canine, grafting the atrophic site, and implant placement after 6 months of healing; immediate implant placement and grafting of the impacted canine extraction site; and exposure of the tooth and orthodontic treatment) were explained to the patient, but she declined these in favor of a faster and less invasive solution. To meet her needs, a less invasive fixed prosthetic solution was adopted using a 4-mm implant. The patient underwent full-mouth professional oral hygiene 2 weeks before the planned surgery and gave informed consent for all surgical procedures. The guidelines of the Declaration of Helsinki were observed. Amoxicillin (2 g) was administered 1 hour prior to implant placement, and the patient rinsed for 1 minute with 0.2% chlorhexidine. The surgical procedure was performed under local anesthesia (4% articaine, 1:100,000 adrenaline; Citocartin, L. Molteni & C. dei Fratelli Alitti). A crestal incision was made, a full-thickness flap was elevated, and a 4 × 4-mm transmucosal short implant (twinkon 4, Global
D) was placed, using dedicated drills with stops, in the maxillary left canine site (Figs 3 and 4). Flaps were carefully sutured with Vicryl 4-0 (Ethicon FS-2, Ethicon). Postsurgical radiographs (periapical radiograph and CBCT scan) were taken after implant placement to verify the correct implant position and the absence of contact with the impacted tooth (Figs 5 and 6). The patient was prescribed 1 g amoxicillin with clavulanic acid twice a day for 6 days and 400 mg ibuprofen twice a day with meals, in the presence of pain, as long as required. The patient was instructed to place 1% chlorhexidine gel on the wound twice a day for 2 weeks and to avoid brushing and trauma on the surgical site, and a soft and cold diet was advised for 1 week.
Results

Sutures were removed after 7 days, and the patient was examined clinically each week in the first month after surgery and twice in the subsequent month. The patient was also enrolled in an oral hygiene program with recall visits every 6 months. Clinical and periapical radiographic checks were made at 4 and 6 months after the surgery, and no complications were detected (Fig 7). The healing process and the postoperative course were uneventful. At 6 months after implant placement, the healing abutment was connected; 2 weeks later a definitive screw-retained prosthesis was delivered, avoiding cuspid guidance and lateral loading (Fig 8).

At 1, 2, 3, and 4 years after prosthetic loading, the implant and the impacted tooth showed no clinical or radiologic signs of failure or complication. No bone loss around the implant was observed, and the patient was fully satisfied from a functional and an esthetic point of view (Figs 9 and 10).
Discussion

According to Dewel,12 maxillary canines have the longest period of development and the longest and most tortuous course to travel from the point of formation, lateral to the piriform fossa, to their final destination in full occlusion. The most common impaction encountered by orthodontists is palatal impaction of maxillary canines.7 Because palatally impacted canines are frequently associated with minor malocclusions,2 occasionally the impaction eludes diagnosis until a much older age, when exfoliation of the deciduous canine occurs or a routine radiographic examination by a general dentist shows the impacted tooth.12

Adults need to know what level of success can be expected in treating the impacted tooth and the duration of the treatment.12 When impacted teeth are asymptomatic and do not undergo any pathologic changes, surgical removal might not be necessary.4 Sometimes, as in the present case, patients ask for rehabilitation of the site after the loss of the deciduous canine. Regarding surgical extraction followed by implant therapy, it should be explained to the patient that impacted tooth removal might be complex and invasive. Moreover, after extraction, bone augmentation procedures are often required before implant placement. An alternative solution is surgical exposure of the tooth followed by forced orthodontic extrusion. It has been demonstrated that canines impacted for many years frequently undergo changes that prevent their eruption even when all other factors seems to be favorable.18 This indicates that the prognosis for a successful orthodontic resolution of an impacted canine in adults is by no means certain and that it worsens with age.12 This is presumably due to ankylosis of the impacted tooth to the surrounding bone.12,18 As a consequence, the patient should be informed of the possibility of failure, a factor that, together with the increased treatment time, must be taken into consideration in the decision-making process from the outset. To avoid surgical removal of the canine, Davarpahah and Szmukler-Moncler19 described several cases of implants placed through the impacted teeth; all the implants healed uneventfully except for an 8.5-mm-long implant that became mobile after 4 months. The authors suggested that placement through an impacted tooth might not interfere with implant integration, but further studies and longer follow-ups are necessary to consider this procedure a predictable clinical treatment.

The use of short implants represents a simplified approach that could reduce operative times and costs as well as intraoperative and postoperative patient discomfort.20 This is even more true if one considers that postoperative pain is greater after surgery on impacted maxillary canines than on other impacted teeth.21 Moreover, when the canine is located near the neurovascular bundle, paresthesia may occur after the surgery.21 Other problems associated with orthodontic traction, such as failure to erupt, bond failure, and ankylosis,22 could be avoided by selecting short implants as an alternative treatment. Furthermore, a short-term (4 months and 1 year after loading) randomized clinical trial (RCT) showed that 4 X 4-mm implants placed in native bone in the presence of adequate bone volume achieved similar results to longer implants.23,24 Two other RCTs seem to confirm these good results, with 4- and 5-mm-long implants achieving similar, if not better, outcomes with fewer complications25,26 than longer implants in augmented jaws. Regarding the debated crown-to-implant ratio, the literature indicates that high ratios are not associated with more peri-implant bone loss or implant failure.27–30 However, some literature shows more prosthetic complications related to a high crown-to-implant ratio. To avoid this kind of problem, the occlusal scheme in the prosthetic rehabilitation of short implants should be carefully planned, for instance in the present case, by avoiding cuspid guidance and lateral loading.

On the other hand, this less invasive implant solution to manage canine impaction cannot be adopted in young growing patients because of the problem of infraocclusion of the adjacent natural teeth.

Conclusions

Within the limitations of this case report, 4-mm-long implants could reduce operative time and costs, complications, and postsurgical morbidity with respect to more conventional surgical or surgical-orthodontic procedures currently
adopted for the management of impacted maxillary canines in adults. As always in implant therapy, accurate case selection combined with precise surgical procedures, followed by appropriate oral hygiene and maintenance programs, are crucial for long-term success. RCTs with longer follow-up are required to demonstrate whether this simplified procedure is a predictable and reliable clinical treatment for impacted canines and to evaluate the long-term behavior of the impacted canine left untouched above the short implant.

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References