The Treatment of a Palatally Impacted Maxillary Canine by Tunnel Traction Method

Palatinalde Gömülü Maksiller Kanin Dişin Tünel Traksiyon Yöntemiyle Tedavisi

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**ABSTRACT**

The patient was a 15-year-old boy who had an Angle Class I malocclusion with a right palatally impacted maxillary canine. The right deciduous canine was also persisted in the mouth. The treatment involved the tunnel traction method, by which the impacted canine was pulled toward the center of the alveolar ridge via the deciduous canine socket. The duration of the traction was 11 months and the total treatment time was 31 months. At the end of treatment, an apically repositioned flap operation was performed to correct the low gingival contour on the buccal side of the maxillary right canine to improve esthetics. The tunnel traction method is an advantageous treatment technique in maxillary canine impaction cases with retained deciduous canine by providing a natural intraosseous tunnel toward the dental arch.

**ÖZET**


**KEYWORDS**

Impacted maxillary canine, Tunnel traction

**ANAHTAR KELIMELER**

Gömülü maksiller kanin, Tünel traksiyon
INTRODUCTION

The palatal impaction of maxillary permanent canines is a frequently encountered clinical problem. Genetic factors are largely responsible for this anomaly\(^1\)\(^2\). Other causes suggested for canine impactions are usually the results of any one or combination of the following factors: Tooth size-arch length discrepancies, prolonged retention or early loss of the deciduous canine, abnormal position of the bud, dilacerations of the root, ankylosis, cystic or neoplastic formation and the absence of the maxillary lateral incisor\(^3\)\(^4\)\(^5\).

The presence of the impacted canine may cause some effects such as migration of the neighboring teeth and loss of arch length, internal resorption, dentigerous cyst formation, external root resorption of itself as well as the neighboring teeth and combinations of the above squeleae. Potential complications emphasize the need for close observation of the development and eruption of these teeth during the examination of the growing child\(^6\).

The orthodontic treatment of a palatally impacted canine is aimed at bringing the tooth into its correct position in the dental arch without causing any periodontal damage. To achieve this goal, a variety of surgical\(^7\)\(^8\)\(^9\)\(^10\)\(^11\) and orthodontic \(^3\)\(^4\)\(^12\)\(^13\)\(^14\)\(^15\) techniques have been proposed in relation to the position of the impacted tooth and to the treatment method used for traction\(^16\)\(^17\). Tunnel traction is one of the approaches for orthodontic treatment of the deep infraosseous impacted canines by providing an osseous tunnel toward the centre of the alveolar ridge\(^18\). This method can be valid when the deciduous canine is persisted in the mouth, so that the socket of the deciduous canine can be used to form a tunnel for movement of the impacted canine. In this case report, we describe the surgical and orthodontic treatment of a palatally impacted canine by using the tunnel traction method.

CASE REPORT

Diagnosis:

A 15 year-old boy was referred to the orthodontic clinic for the unesthetic appearance of his crowded maxillary anterior teeth. The clinical examination revealed an Angle Class I molar relationship, a highly positioned maxillary left canine on the vestibule and a persistent right deciduous canine. The permanent right canine was not seen in the arch. There was also a total of 2 mm diastema between the central incisors and the right lateral incisor. Mandibular teeth were aligned reasonably well with a 2 mm diastema between left canine and first premolar (Fig 1A-L). The radiological examination showed that the right permanent canine was impacted palatally (Fig 2A-C).
FIGURE 1

(A) Pretreatment extraoral facial photograph  (B) Pretreatment extraoral lateral photograph  (C) Pretreatment smiling photograph  (D-G) Pretreatment intraoral photographs
FIGURE 1

(H-L) Pretreatment study models

FIGURE 2

(A) Pretreatment panoramic radiograph (B) Pretreatment occlusal radiograph
Treatment:

The objective of treatment was to prepare adequate space for the upper canines and properly positioning the impacted right canine into the arch to obtain a good alignment of the teeth. Because the lower teeth were in good alignment, no treatment was planned in the lower jaw.

A transpalatal arch was used for providing anchorage during the traction of the impacted canine. .018 x .025 inch Roth brackets were bonded to the maxillary teeth. Initial leveling was accomplished with a .016 x .016-inch nickel titanium wire, followed by a .016 x .022-inch stainless steel wire. Open-coil springs were used to gain spaces for the maxillary canines. Then, .016 x .022-inch stainless steel wire with a helix on the right canine side was inserted. The helix was bent to be used for tying the gold chain during traction of the impacted canine. The deciduous right canine was not removed and kept in place during the preoperative orthodontic treatment. Following 10 months of orthodontic therapy, the patient was referred to the surgeon for exposure of the impacted canine.

Surgical procedure:

A full thickness mucoperiosteal flap was raised to expose the cortical plate and the deciduous canine was extracted. Cortical bone was removed to provide access to the crown. With a low speed bur, a perforation on to the bone from the socket of the deciduous canine was performed to reach the crown of the impacted canine. The socket of the deciduous canine was then formed like an osseous tunnel that would be used for traction. A gold-chain bonded on the impacted tooth was passed through the tunnel. The flap was sutured back into its original position.

Treatment progress:

One week after surgery, the sutures were removed and the traction phase began. Elastic thread was placed through the first link of the gold chain and tied to the helix on the arch, applying a traction force to the impaction canine. The direction of the traction was directed toward the center of the alveolar ridge (Fig 3A-D). During the traction phase, the movement of the impacted tooth was guided through the tunnel. As the canine moved closer to the designated position more gold chain became exposed through the mucosa. Excess chain was then cut. This was repeated every 2 weeks until the impacted canine and the attached part of the chain became exposed in the oral cavity and the cusp of the impacted canine emerged at the center of the alveolar process. The postsurgical panoramic radiograph shows the canine in its proper position (Figure 3E). The gold chain was eventually removed and the canine bracket was bonded to the upper right canine. .016-inch and .016 x .016-inch nickel titanium arch wires were used to level the right canine sequentially. When the canine was completely aligned within the dental arch, a finishing arch wire of .016 x .022-inch stainless steel was placed and the patient was seen at monthly intervals. The brackets were debonded after good alignment and interdigitation of teeth were achieved (Fig. 4A-C). As the gingival contour of the right canine was lower than the left
At the start of traction phase: (A) Intraoral lateral photograph (B) Occlusal photograph (C) Occlusal radiograph (D) Panoramic radiograph (E) During traction: Canine directed into its proper position

(A-C) Posttreatment intraoral photographs
one, an apically repositioned flap was performed to correct the gingival contour.

**Results:**

At the end of treatment, the palatally impacted maxillary right canine was positioned into proper alignment, resulting in a pleasing smile. (Fig. 5A-L) Radiographically, the right canine displayed proper root inclination and the incisors remained stable at the end of treatment (Fig. 6A-C). The duration of the traction was 11 months which elapsed between the application of the traction and the eruption of the cusp of the impacted canine. Total treatment time was 31 months. For retention, a Hawley retainer was placed and the patient was instructed to wear it 24 hours a day.

The impacted canine was brought into the arch and properly without complaints of significant discomfort. There was no attachment loss at the site of the impacted canine during the treatment, and the maximum probing depth was 3 mm. The pseudo-pocket on the buccal side of the right canine tooth was corrected by a flap

![Figure 5](image)
FIGURE 5
(D-G) Posttreatment intraoral photographs

FIGURE 5
(H-K) Posttreatment study models
operation. No root resorption of the adjacent teeth was seen on the periapical radiographs during the traction of the impacted canine.

DISCUSSION

Maxillary permanent canines are important for an attractive smile and are also essential for a functional occlusion. Therefore, extraction of the canines should be avoided, if at all possible. In the case of maxillary impaction, surgical exposure of the related tooth and the use of fixed orthodontic appliances is the most frequently used treatment alternative as long as the tooth position is favorable. Various methods have been used for moving the canine into proper alignment. Fournier et al. have proposed the use of a removable plate. Becker and Zilberman have recommended the use of a flexible palatal arch slotted into horizontal, soldered, palatal tubes on the molar bands of any type of fixed multibonded appliance. Jacoby has suggested his ballista spring to direct a palatal-occlusal force from the buccal side.
In this report, the successful treatment of a palatally impacted maxillary canine using the tunnel traction method was presented. The only study presenting the long-term effect of the tunnel traction method was reported by Crescini et al.\textsuperscript{18} The advantage of this technique was that the impacted canine was moved through an osseous tunnel to its proper place on the dental arch. However, this method could be used in the presence of a retained deciduous canine tooth on the affected side.

The duration of the traction needed to resolve the impaction was 11 months and the total treatment time was 31 months in this case. Crescini et al.\textsuperscript{18} also reported 11 months of tunnel traction time. However, their total treatment time was 22 months. Becker and Chaushu\textsuperscript{19} revealed that in young patients, the duration of canine traction took about one third of the overall treatment time. The duration of the treatment for the impacted canines was reported to change due to age, gender, molar relation, severity of impaction, amount of crowding, unilateral and bilateral impactions. Thus, individual treatment times for the impacted canine teeth showed a large range\textsuperscript{20}.

This case report showed that with the use of the tunnel traction method, the right palatally impacted maxillary canine was erupted in its proper place on the dental arch without giving any damage to the neighboring teeth. It has been reported that the orthodontic treatment of palatally impacted canines may cause root resorption of the adjacent lateral incisors\textsuperscript{21} or premolars\textsuperscript{22}.

After the completion of the orthodontic treatment, the buccal gingival height of the impacted teeth often needs correction\textsuperscript{8} though some authors\textsuperscript{18} suggested no gingival augmentation procedure after treatment of impacted canines with the tunnel traction method. In presented case, an apically repositioned flap was performed to increase the clinical crown height of the right canine. The patient’s smile esthetics was improved following the procedure.

**CONCLUSION**

The impacted canine associated with the persistent deciduous canine was treated successfully by tunnel traction method. The extraction of the deciduous tooth provided a natural osseous tunnel for movement of the impacted tooth. Traction through the osseous tunnel ensured an eruption path that closely follows the physiologic pattern.

**REFERENCES**


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