

## Management of impacted maxillary canine with surgical exposure and alignment by orthodontic treatment

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### ABSTRACT

**Background:** Maxillary canines play a critical point in creating an aesthetic smile as they support the part of facial muscle. Canines are also the second most frequently impacted teeth after the third molars. In some cases, it is possible to retract canines into their correct position by orthodontics treatment. **Purpose:** This article highlighted a treatment option with surgical exposure, in which a maxillary canine was impacted. It presented gradual steps from pre-surgical to post-surgical orthodontic treatment. **Case:** A 16 years old female patient referred to Orthodontic Department by Oral Surgeon for pre-surgical orthodontic treatment of her impacted maxillary canine.

**Case Management:** After pre-surgical orthodontic treatment, the impacted canine was surgically exposed by closed technique since open surgical exposure might need excessive removal of the surrounding bone. Traction was given through a gold chain which attached to the palatal surface of the impacted canine. The tooth was ideally positioned with fixed orthodontic appliances. The permanent right maxillary canine was successfully positioned into proper alignment with the remaining teeth. Aesthetic smile was improved.

**Conclusion:** Malocclusion with impacted canine was successfully treated with MBT orthodontic prescription combined with gold chain that can retract the impacted canine into its physiological position and the patient was satisfied with the aesthetic result.

**Keywords:** tooth impacted; orthodontic appliance; medicine; dentistry; tooth movement technique

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### INTRODUCTION

Canine impaction is a condition in which the canine is embedded in the surrounding tissues so that the eruption is prevented. Impactions are twice as common in females as in males with palatal impactions being twice as common as labial impactions. Impacted maxillary canines are a rather frequent condition. When the third molar is excluded, the maxillary canine is the most often impacted tooth. The prevalence of impacted maxillary canines has been observed to range between 0.9 and 3.3%. The maxillary impacted canine is more commonly seen palatally (85% of the time) than labially (15%). Root dilaceration has been recorded in up to 59.5% of cases.<sup>1</sup> The prevalence of palatally impacted canine of the worldwide population ranges from 0.27% to 2.4%.<sup>2</sup> There are several options to

treat impacted canine: No treatment—leaving the tooth where it is, removal of the tooth if orthodontic treatment is not possible, and surgical exposure followed by orthodontic treatment.<sup>3</sup> After surgical exposure, the impacted tooth may erupt naturally during early to late mixed dentition period or moved orthodontically after bonding an attachment on the tooth.<sup>4</sup> The goal of this research was to provide a strategy for surgically exposing an impacted maxillary canine and orthodontically placing it. The cosmetic and functional care of impacted canines is critical. The effective alignment of impacted canines requires careful surgical and orthodontic procedure selection. Even though there are very many published-articles about management of impacted maxillary canine with surgical exposure, this study describes the MBT orthodontic prescription combined with gold chain to treat the malocclusion with canine impaction. This article

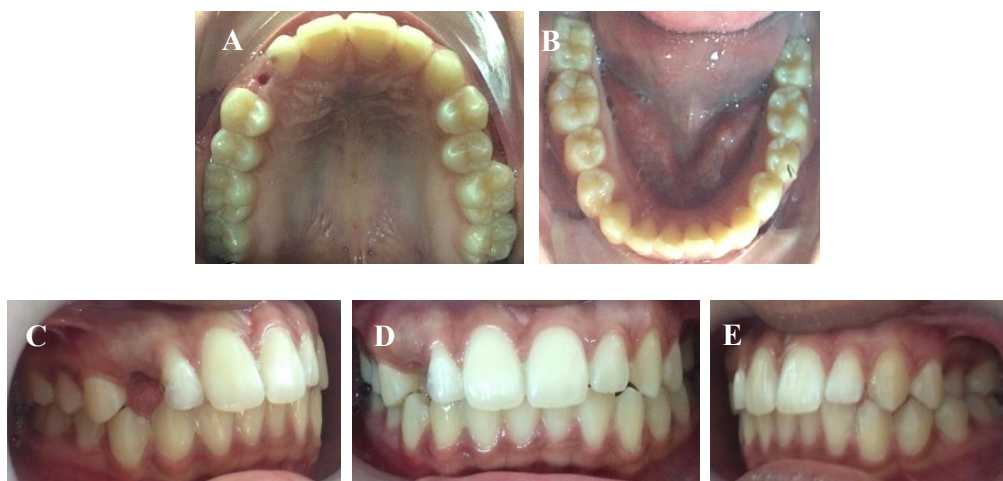
highlighted a treatment option with surgical exposure, in which a maxillary canine was impacted. It presented gradual steps from pre-surgical to post-surgical orthodontic treatment.

**CASE**

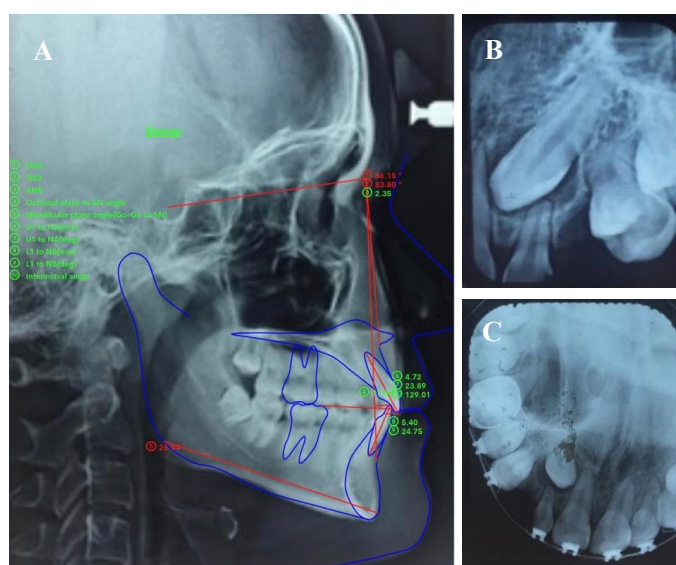
This case report was granted permission from the patient and patient’s guardian willing to fill the written informed consent for the scientific publication. A 16 years old female patient presented to Orthodontic Department as referral from Department of Oral Surgery. The patient wanted to have her upper right decayed tooth extracted. The tooth which she referred was a deciduous canine. The periapical radiograph showed the permanent maxillary canine which should have replaced the primary canine was impacted.

It was palatally placed and borne in semi-vertical position, classified as Class I case. The radiograph also showed the agenesis of permanent right maxillary lateral incisor.

Intra-oral examination showed Angle Class I malocclusion with mild crowding in lower anterior and upper posterior, scissor bite of 25/35, and 2 mm upper mid-line shift (Figure 1 A-E). The patient had a negative arch length discrepancy as much as 1.5 mm in both the upper and lower arches. Extra-oral examination showed straight facial profile. Cephalometric radiograph showed  $\angle$  SNA 87.5°,  $\angle$  SNB 85°,  $\angle$  ANB 2.5°,  $\angle$  I-NA 27°,  $\angle$  I-NB 28°,  $\angle$  FH-NP 90°,  $\angle$  NAP 3°,  $\angle$  Y-Axis 57.5°, interincisal angle 117°. The upper and lower lips were in the normal range based on Ricketts’ and Steiner’s analysis (Figure 2A). In addition, the impacted canine was examined with periapical radiography analysis, as can be seen in Figure 2B and 2C.



**Figure 1.** Pre-treatment intra oral view, (A) maxillary occlusal, (B) mandibular occlusal, (C) sagittal right side, (D) anterior view, (E) sagittal left.



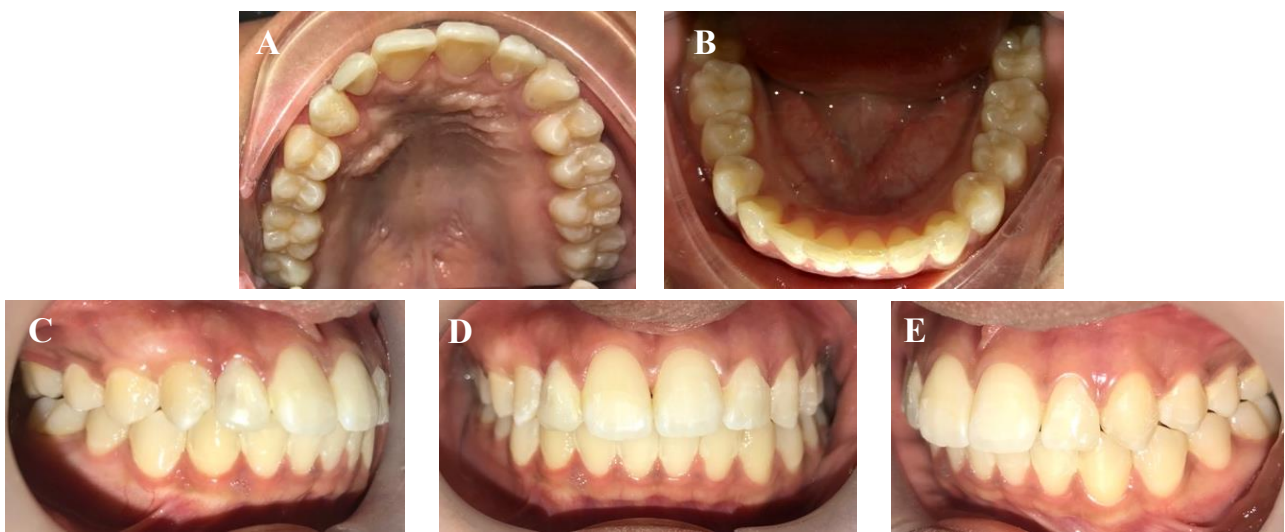
**Figure 2.** Pre-treatment radiograph of patient case. (A) Cephalometry digital analysis, (B) canine impaction examined with periapical radiography, (C) canine impaction radiography occlusal view.



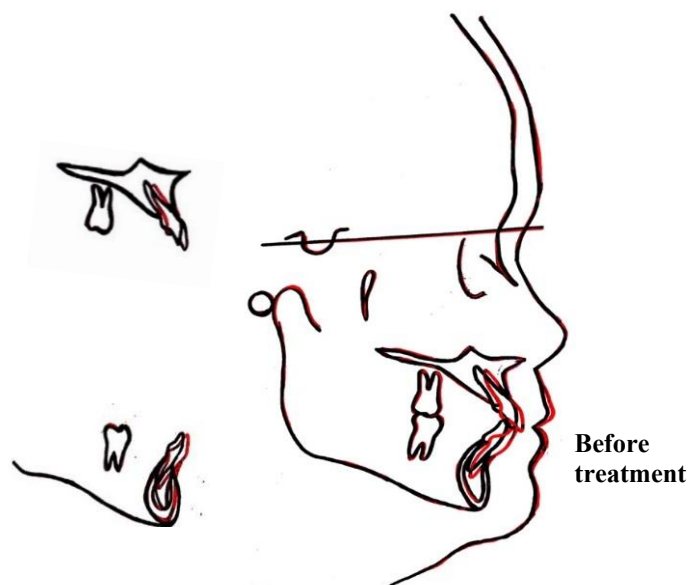
**Figure 3.** Traction of maxillary canine using gold chain.

### CASE MANAGEMENT

The main treatment goals for the patient were to improve the patient's cosmetics as well as the functional occlusion by aligning and occluding the permanent canine. Surgical exposure of the impacted maxillary canine was planned, followed by directed pressures to correct the canine's position. Correction of posterior crowding and a 25/35 scissor bite in the maxillary arch were planned, as were correction of anterior crowding and a mid-line shift in the mandibular arch. Pre-surgical orthodontics consist of maxillary and mandibular arch alignment start from initial NiTi to 0.016" x 0.022" stainless steel arch wires. NiTi open coil spring was inserted between deciduous lateral incisor and first premolar in upper right region in every



**Figure 4.** Post-treatment intra oral view. (A) maxillary occlusal, (B) mandibular occlusal, (C) sagittal right side, (D) anterior view, (E) sagittal left.



**Figure 5.** Superimposed cephalometric radiograph before (black line) and after treatment (red line).



stage. Adequate anchorage was planned before canine exposure by using bands on first molars and tubes on second molars in upper arches. After the space for canine had been obtained, exposure was performed by a close window procedure. The MBT orthodontic prescription was conducted in this study.

The exposed crown area was covered in gold chain. In addition to the scissor bite correction, a glass ionomer cement bite block was placed on the mandibular posterior teeth to prevent obstruction and promote mobility of the maxillary canine. Light orthodontic forces were applied by placing the end of the chain into the 0.016" x 0.022" stainless steel wire which inserted to the bracket slots. The chain was activated every two weeks. The force was increased by using ligature wire. After the canine was close enough to the wire, the chain was replaced by bracket attachment on labial surface of the crown. Double wires technique was used to pull the canine into the arch. After completion of the traction, a series of stainless-steel wires (up to 0.019" x 0.025") were ligated. Triangle elastics were used. Final alignment and leveling accomplished, followed by passive and retention phase using Hawley retainer.

Leveling-aligning and canine space regaining for surgical preparation took six months. After the exposal treatment, there were no complications observed at the surgical site, and the gingiva remained healthy. The canine was pulled out using gold chain (Figure 3). In the first two weeks, the chain remained passive, then the forces were increased by using ligature wire. This process took 10 months until the canine was close enough to the wire and the chain could be replaced by bracket. Re-leveling to finishing and detailing needed four more months before the whole arches could be ligated passively for two months before debonding.

After the whole treatment process, the permanent upper right canine was positioned into proper alignment with the remaining teeth. The upper mid-line shift and 25/35 scissor bite were corrected. The upper posterior and lower anterior crowding was aligned (Figure 4A-E). Post-treatment cephalometric radiograph showed  $\angle$  SNA 86.15°,  $\angle$  SNB 83.8°,  $\angle$  ANB 2.35°,  $\angle$  I-NA 23.89°,  $\angle$  I-NB 24.75°,  $\angle$  FH-NP 90°,  $\angle$  NAP 3°,  $\angle$  Y-Axis 57.5°,  $\angle$  interincisal 115°. Upper and lower lips were in normal range based on Ricketts's and Steiner's analysis. Superimposed cephalometric radiograph showed no changes in any skeletal aspects (Figure 5). As for the dentition, the interincisal angle were slightly increased and brought the lips forward, but it did not have any impact to the patient's profile. The overall result was quite acceptable and fulfilled patient expectation.

## DISCUSSION

Permanent canine teeth are essential for functional occlusion, dental aesthetic and a well-balanced grin. Canines also give the cheeks a lot of support. The lack

of canines leads to a flattened upper lip.<sup>5,6</sup> Impaction in dogs has been linked to an increased risk of infection and cyst formation.<sup>2</sup> Canine impaction can be caused by various factors. Localization, such as tooth size and arch length discrepancy, prolonged retention or early loss of primary canine, ankylosis of permanent canine; systemic condition; and genetics.<sup>2</sup> In this case, what probably caused the impaction of canine could be the absence of permanent lateral incisor. According to the guidance theory, the canine erupts along the root of the lateral incisor, acting as a guide. The canine will not erupt if the root of the lateral incisor is missing or deformed.<sup>6,7</sup> The deciduous lateral incisor is still maintained in the end of treatment. It is not replaced. Otherwise, it is restored with veneer due to the proficient condition of the root.

There are some options to treat impacted canine. In this case, surgical exposure was chosen because of several considerations—the canine position, where the tip was at the cervical third of the adjacent tooth; severity of impaction, which the canine lied at less than 45° angle; patient age, and patient consent. An apical third with 30-45° angle of impacted canine position is the most favorable for orthodontic traction.<sup>8,9</sup> Before the oral surgeon perform the maxillary impacted canine treatment, cone-beam computed tomography (CBCT) examination may helpful to determining maxillary bone density.<sup>6,10,11</sup>

The most common method used in surgical exposure is to allow the tooth to erupt naturally during early or late mixed dentition. But some factors e.g denser palatal bone, thicker palatal mucosa and a more horizontal position causes palatally displaced cuspids to be impacted and they rarely erupted without requiring complex biomechanical intervention. So, a closed flap technique can be employed in which the impacted tooth is surgically exposed and gold chain is bonded. Then orthodontic forces are used to move the tooth into oral cavity.<sup>12</sup> In the present case, a closed flap technique was used which usually produces best gingival aesthetics and increased ease of tooth movement.<sup>13</sup>

At the end of treatment, the inclination of upper incisive angle was slightly increased. It happened because of the occurring thrust due to the canine appearance in the arch. The space regaining for the impacted canine using NiTi coil spring in the initial phase was also beneficial for mid-line shift correction. The mid-line shift appeared because of the non-existence of the permanent canine, where the primary canine also failed to maintain the space due to caries.<sup>14</sup> Whereas in lower arch, the incisive angle was increased because of the anterior crowding correction. It normally happens in non-extraction cases, leading the soft tissue to move forward.<sup>15</sup>

From this case report, it can be concluded that the treatment goal has been achieved to treat the malocclusion with impacted canine. The impacted canine could be retracted with gold chain combined with MBT orthodontic prescription into its physiological position and the patient was satisfied with the aesthetic result and stomatognathic function.

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