



Case report

## SEVERELY IMPACTED CANINE: HIGH RISK OR GREAT CHALLENGE TO OVERCOME?

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### ABSTRACT

Canine impaction is a common issue in orthodontics. Canines play important functional and esthetic roles in humans, and altered eruption of these teeth is an important patient concern. Therefore, a sound diagnostic and therapeutic approach and clear knowledge of all prognostic implications are mandatory for timely diagnosis and appropriate treatment planning.

Early diagnosis and intervention are extremely important. Untreated impacted canines can result in various complications, including displacement and loss of vitality of the adjacent teeth, arch length discrepancy, dental midline shift, formation of follicular cysts, ankylosis, recurrent infections, pain, caries decay, internal resorption, external resorption of the canine and adjacent teeth, or combinations of thereof.

Due to advanced diagnostic techniques, an increasing number of patients with impacted canines are diagnosed early and referred for treatment, satisfying their increasing demands for oral health. Here, a case of an impacted maxillary canine in a young patient is reported, and the literature is discussed.

Keywords: *cuspid, inclusion, surgery, orthodontics, tooth*

### INTRODUCTION

Impaction is defined as the failure of tooth eruption at its pre-determined site in the dental arch within its standard period of growth due to an obstacle in the eruption path or ectopic position of the tooth germ (1). Canine impaction is a

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common issue in orthodontics. Maxillary canines are the second most frequently impacted teeth after the third molars, with a prevalence ranging from 0.9 to 5%. It is more difficult to find clinical guidelines derived from studies based on large population sample allows the permanent canines to erupt normally and prevents their potential impactation (2-7). In orthodontics, dentistry, and, more generally, medicine, providing the patient with multiple options is mandatory to achieve better outcomes, solve problems, and improve the overall quality of life.

Early diagnosis and intervention are extremely important. Untreated impacted canines can result in various complications, including displacement and loss of vitality of the adjacent teeth, arch length discrepancy, dental midline shift, formation of follicular cysts, ankylosis, recurrent infections, pain, caries decay, internal resorption, external resorption of the canine and adjacent teeth, or combinations of thereof (1-7).

With advanced diagnostic techniques, an increasing number of patients with impacted canines are diagnosed early and referred for treatment, satisfying their increasing demands for oral health.

A detailed assessment of the impacted maxillary canine's location, angulation, and orientation is essential for planning treatment. A variety of radiographic assessment tools have been used for evaluation and classification. Two-dimensional (2D) panoramic X-ray has limitations, but three-dimensional (3D) cone beam computed tomography (CBCT) allows detailed localization of impacted canines and their relation to adjacent teeth (8, 9).

Impacted maxillary canines may present a wide three-dimensional range of variations with a corresponding difference in treatment difficulty.

The success of treatment is related to the complexity, duration, complications, and functional and esthetic outcomes. Therefore, evaluating the burden of care and treatment outcomes is paramount for case selection for specific interventions to improve the overall predictability and quality of treatment of impacted maxillary canines. In the literature, different treatment approaches are described:

- 1) extraction of the primary canine, allowing spontaneous eruption of the impacted permanent tooth;
- 2) extraction of impacted canine followed by implant placement on the site or orthodontic closure of the space;
- 3) orthodontic traction of an impacted canine, with or without the need for previous surgical exposure;
- 4) autotransplantation of impacted canine (7).

This case report describes the management of an impacted maxillary canine in a young patient.

## CASE REPORT

### Diagnosis

A female, aged 13 years, came to the Orthodontic Department in July 2012 with upper and lower fixed appliances since she was already undergoing orthodontic treatment in a private office. Her request was to attempt the disinclusion of the upper right canine for which the extraction with subsequent implant-prosthetic rehabilitation was previously planned.

Extraoral examination revealed a symmetrical face with a reduced lower third and a harmonious smile arch. The profile was concave with an increased Z angle and a pronounced labio-mental groove (Fig. 1).



**Fig. 1.** Pretreatment extraoral and intraoral photographs.

Intraoral examination revealed in the frontal view a slight deviation of the upper right dental midline, microdontia of the upper lateral incisors, and an altered Bolton index. A normal OVJ and a bilateral class I were detected in the lateral view. In the occlusal view, the upper arch had diastema in the anterior sector with space in the right canine area by the previous fixed appliances. The lower arch had slight antero-inferior crowding and dental rotations.

The cephalometric analysis showed a skeletal tendency to class III malocclusion with mandibular protrusion and a hypodivergent growth pattern, and the proclination of the incisors.

The cervical vertebral maturation (CVM) analysis showed a skeletal maturation stage CS6, so the patient had passed the pubertal peak (Fig. 2).

The panoramic x-ray showed 1.3 impactions, so the angle formed between the axis of the canine and the midline was increased compared to the norm value, and the vertex of the canine cusp was positioned mesially (in sector 1 according to the classification of Ericson and Kuroi, that corresponded to Lindauer's sector IV). As a result, the distance between the canine and occlusal plane was high - 15 mm (Fig. 3).



Fig. 2. Radiographs showing hand-wrist (HW) and cervical vertebral maturation (CVM).

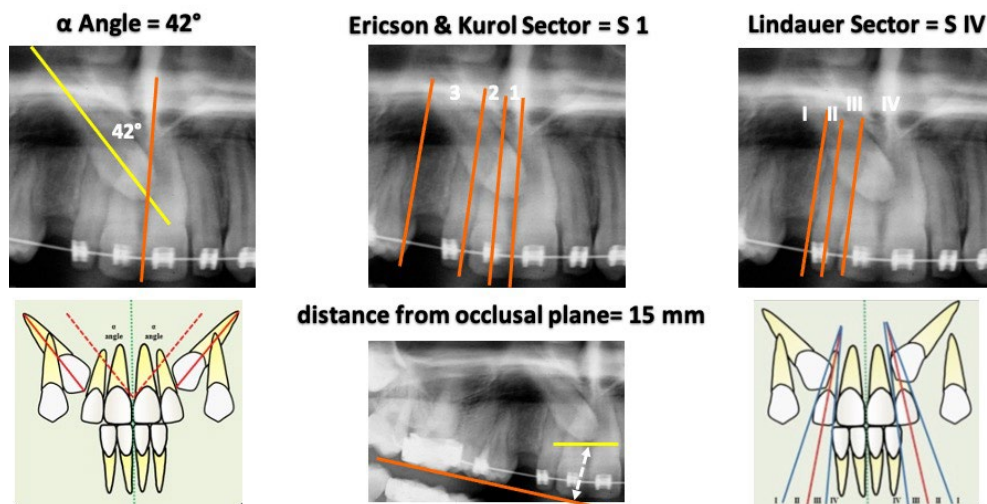


Fig. 3. Panoramic x-ray examination.



Fig. 4. Initial treatment phase.

### *Treatment objectives*

The main treatment objectives were: surgical exposure and orthodontic repositioning of 1.3, correction of the upper midline, correction of the slight lower crowding, and control of the mandibular protrusion. The active treatment was carried out with a prodigy-type fixed self-ligating device, transpalatal arch, miniscrews, auxiliary sectionals, class III, and intercuspation elastics.

Moreover, the coronoplasty of 1.2 and 2.2 was performed during the recovery of the upper space. The retention phase included a Hawley retainer appliance in the upper arch and a cuspid-to-cuspid fixed retainer in the lower arch.

### *Other treatment options*

Various therapeutic options were described to the patient and her parents. The first was surgical exposure and orthodontic repositioning in the 1.3 arches; the second was first extraction and replacement and implant-prosthetic replacement at 18 years. The third option was the extraction of the included canine and the closure of the space by mesialization of the posterior-posterior sectors with the disadvantage of creating a class 2 relationship on the right. The fourth option, to be listed albeit obsolete, was a treatment with surgical exposure and extraction of the canine with subsequent self-transplant. Lastly, no treatment is an option when discussing not vital therapies. Among all, the first recommended option was approved by the parents.

### *Treatment progress*

As a first step, the previously fixed equipment was removed. In the same session were fixed self-ligating brackets type FACE prodigy from the second premolar to the second premolar and bands on the first molars with .014 NiTi archwires on both jaws and the addition of a closed stainless steel passive coil between 1.2 and 1.4 for the space maintenance of the canine region (Fig. 4).

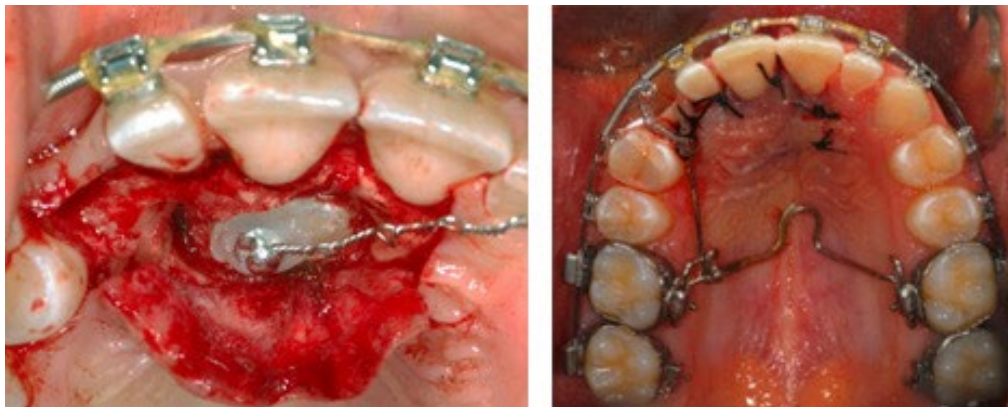
The exposure of the canine was carried out with a full-thickness palatal flap, positioning of a button on the exposed surface and a metal wire .011 intertwined with eyelets (Fig. 5). The traction of the canine was carried out with a lever in TMA .017x.025 attached to the transpalatal arch with activation of 45° and distal and extrusive direction (Fig. 5).

Panoramic X-ray showed a lower inclination of the canine axis and a shorter distance from the occlusal plane, a shift also confirmed by clinical examination and palpation.

An orthodontic miniscrew was positioned in the lower arch between 4.4. and 4.5. (Aarhus System Miniscrews of American Orthodontics 8 mm x 1.5 mm in diameter) consequently, a slight loss of anchorage in the upper right arch, with an initial displacement of the occlusal was obtained (Fig. 6). The traction of the canine continued with the application of elastic between a hook tied to 1.3 and the head of the miniscrew.

The canine surface clinically appeared in the palate four months after the application of the miniscrew. Next, a lever with an Australian .020 thread was applied directly between the transpalatal arch and the button on the canine.

The following archwires sequencing was used: .016 nickel-titanium, .020x.020 Niti Bioforce, .019x.025 nickel-titanium, .019x.025 stainless steel. The retention phase included a Hawley retainer appliance in the upper arch and a cuspid-to-cuspid fixed retainer in the lower arch.



**Fig. 5.** *Impacted canine exposure and traction.*



## RESULTS

The treatment goals were achieved. The canine was repositioned on the arch, and the skeletal relationship was controlled with a nice facial profile. The occlusal, functional, and esthetic results were satisfactory; therefore, the patient and her family were happy with her smile. The patient presented class I molar and canine relationship and good intercuspation. The patient showed a full smile, maintenance of the class I molar and canine relationship, centered median lines, and a good upper arch. The end-treatment panoramic x-ray showed that all roots were in good parallelism (Fig. 7). The patient was also fully satisfied with the results. The cephalometric analysis and the overlaps showed skeletal class I and control of the mandibular protrusion, with a slight reduction in the ANB and Wits index and good control of the incisive proclination. The treatment lasted less than 3 years and comparing the initial and final check-ups highlighted the results achieved and the patient's satisfaction.

## DISCUSSION

Maxillary canine impaction usually needs multidisciplinary care, which involves oral surgery, periodontics, and orthodontic treatment. The clinicians working on the case must communicate well to provide optimal patient care (10). The management of impacted canines can be divided into two treatment categories: interceptive treatment and corrective treatment.



Fig. 6. Miniscrew positioned between 4.4. and 4.5.

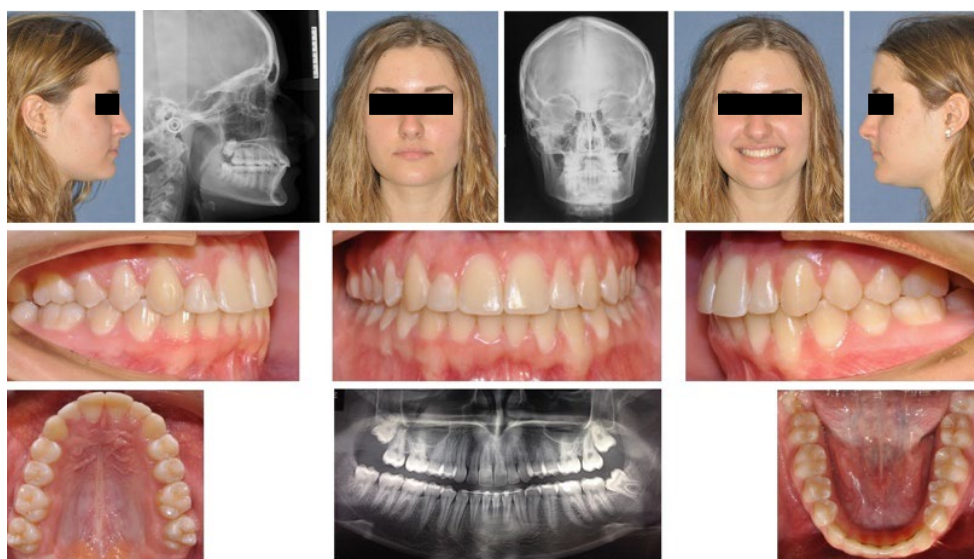


Fig. 7. Post-treatment records.

The impacted canine is always challenging for orthodontists, particularly when the patient is in permanent dentition after the pubertal growth peak (11, 12).

Preventing maxillary canine impaction is the ideal form of treatment and provides the best long-term results. Orthodontic management of impacted canines may offer considerable challenges.

Good tomographic images are fundamental to a successful therapy since they allow professionals to accurately identify and locate the position of the impacted tooth, evaluate possible injuries to adjacent roots, and quantify the bone around each tooth. It also helps detect possible ankylosis in the roots of such teeth (13), which could be interpreted as the most probable cause for them failing to reach the expected position during the eruptive movement. Visualizing these ankylosed zones may help professionals choose a different treatment protocol than conventional surgical exposure followed by orthodontic traction; this will assist in the right choice for either the impacted tooth extraction, auto-transplantation, or the execution of a deep alveolar corticotomy followed by immobilization, especially if the canine is more labially positioned. The success of early interceptive treatment for impacted maxillary canines is influenced by the degree of impaction and the patient's age at diagnosis (14).

The most desirable approach for managing impacted maxillary canines is early diagnosis and interception of potential impaction. The most common methods used to bring palatally impacted canines into occlusion are surgically exposing the teeth and allowing them to erupt naturally during early or late mixed dentition (15) and surgically exposing the teeth and placing a bonded attachment to and using orthodontic forces to move the tooth (10).

To prevent undesirable periodontal responses, clinicians should consider factors including impaction depth, the edentulous site's anatomy, and the orthodontic force's speed and direction (16). The results of several studies have shown that surgical exposure and orthodontic eruption of palatally impacted maxillary canines have minor effects on the periodontium (15, 17,18, 19).

In cases of surgical exposure aimed at triggering impacted canine displacement, good communication between the orthodontist and the surgeon is essential to adopt the most appropriate technique. In order to choose the type of surgical exposure (open or closed), elements like impaction depth, anatomy of the edentulous area, and the type of orthodontic force to be employed are some of the factors to be considered.

The treatment options and benefits of each therapeutic modality must be presented to the patient and parents. Also, the risks of the impacted canine surgical exposure may have iatrogenic consequences, including damage to the impacted canine and the neighboring teeth; damage to blood vessels and nerves adjacent to the impacted tooth and, in severe cases, bone fracture; these risks must also be presented to the patient. In the end, managing impacted canines are important in terms of esthetics and function (20).

Finally, regarding general risk, doctors have always to wear protection systems when treating the patient, as the recent pandemic has demonstrated (21-23).

In conclusion, the canines play an important functional and esthetic role, and altered eruption of these teeth is an important patient concern. Indeed, untreated impacted canines can result in various complications, so early diagnosis and intervention are extremely important.

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