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## Case Report

# Displacement of an impacted maxillary canine root fragment into the nasolacrimal duct: A diagnostic dilemma



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## ABSTRACT

Maxillary canines are the second most common impacted teeth after third molars. The surgical removal of impacted canines should be carefully considered in order to avoid intra- and post-operative complications. To reduce the chance of unwanted consequences, a thorough and careful diagnostic process including sufficient radiographic examination must be performed. Conventional radiographic techniques are commonly used for localization. However, advanced 3D imaging should be done in cases where 2D radiographs cannot provide sufficient information regarding the position of an impacted canine and its relationship with surrounding structures to minimize surgical complications.

Here, we reported a rare case, in which an impacted canine root fragment was displaced into the adjacent nasolacrimal duct. This situation leads to partial duct obstruction. Through discussion of this case, we drew attention to a few subtle features of 2D radiographs showing the need and rationale for advanced imaging modalities such as CBCT as supplementary options.

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## 1. Introduction

Impacted teeth are teeth which do not have enough space for eruption into the oral cavity. Commonly, their eruption paths are blocked by other structures. Impacted teeth can cause detrimental effects including damage to nearby teeth and are sometimes associated with cysts or tumors. The prevalence of impacted maxillary canines is reported to be 0.9–3% [1–5], which is second only to mandibular third molars [6,7]. Impacted maxillary canines occur twice as often in females than in males and have a high familial association. The incidence of impacted maxillary canines in Caucasians is fivefold that of Asians [8,9]. Eighty-five percent of impacted permanent maxillary canine crowns are palatal in position, while the remaining are in labial aspect [10–12]. Management of impacted maxillary canines includes orthodontic treatment with or without surgical treatment, which requires accurate diagnosis

and precise determination of the location, inclination, and longitudinal axis of the impacted canine in relation to surrounding structures [13,14]. Several conventional radiographic techniques are used during treatment planning of impacted teeth, including periapical, topographic or cross-sectional occlusal, panoramic, and cephalometric radiographs or a combination of these views using parallax or right angle techniques [15]. However, it is often difficult to distinguish minute details and to accurately define anatomical relationships [1]. Therefore, limited field of view (FOV) 3D imaging could be considered as an alternative for particular cases that demand detailed information regarding neighboring structures (i.e. relative inclination of the impacted tooth, adjacent root resorption or thickness of overlying bone) in order to reduce possible surgical or non-surgical complications and to increase value in treatment planning for a more predictable outcome.

Several potential consequences may arise during the removal process of impacted maxillary canines such as injury to adjacent teeth, fractured roots, and perforation into nasal cavity or maxillary sinus with or without displacement of the root fragment. The latter one may subsequently lead to secondary acquired lacrimal drainage obstruction.

The nasolacrimal duct is a structure which carries tears from the lacrimal sac into the nasal cavity through its superior intraosseous and inferior membranous portions. The anatomy of

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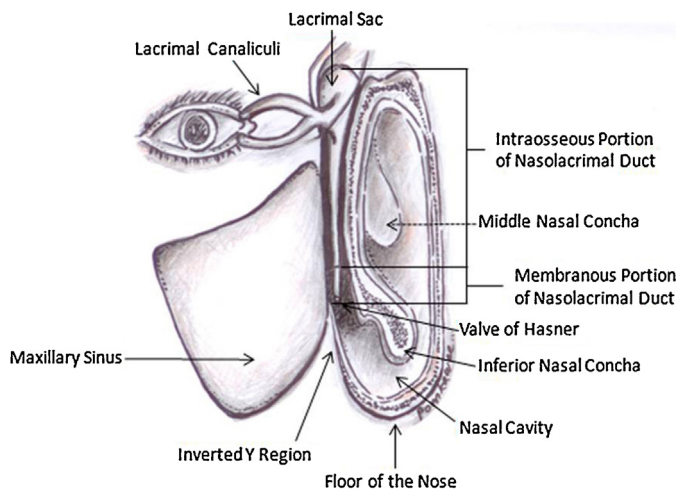


Fig. 1. The anatomy of the nasolacrimal duct.

the nasolacrimal duct is shown in Fig. 1. The intraosseous portion of the duct starts from the medial aspect of the eyes and travels posterolaterally along the lateral nasal wall, while the 5-mm long membranous or meatal part runs beneath the nasal mucosa [16–19]. Eventually, the canal opens into the inferior meatus under the inferior nasal turbinate through a pin-point, triangular or slit-like opening known as the valve of Hasner [20]. The reported mean length of the intraosseous part is  $11.2 \pm 2.6$  mm (range: 6–21 mm), and its average diameter is  $3.7 \pm 0.7$  mm (range: 2–7 mm) [21]. The size of the canal varies with patient's age, sex and race [16]. Its diameter is larger in males than females and increases in size with age [17,18]. There is also a geographic variability, as Pacific people are shown to have wider canals than Caucasian or New Zealand Maori [17]. The possibility of any foreign body entering the nasolacrimal duct is minimal.

In this report, a rare case of surgical complication in which the canine root fragment was displaced into the nasolacrimal duct, potentially leading to partial obstruction of the duct, is reviewed. Through discussion of the case, we drew attention to a few subtle features of 2D radiographs showing the need for advanced imaging modalities such as CBCT as a supplementary option to avoid such problems.

## 2. Case report

A 21-year-old female was referred from an orthodontist to the Oral and Maxillofacial Surgery Clinic at the Faculty of Dentistry, Chulalongkorn University for surgical removal of an impacted right permanent maxillary canine. An original panoramic radiograph was available at the time, but was missing during preparation of the current publication. It was reported to have an impacted canine with the crown located between the roots of lateral incisor and first premolar, and the root positioned high in the inverted Y region. The patient underwent surgical removal of this tooth under local anesthesia. A full mucoperiosteal flap was reflected, and the labial cortex covering the crown of the impacted canine was removed before elevating the canine. During this procedure, the apical one-third of the root fractured and was retained in the site. An attempt to remove the root fragment failed, and the root fragment disappeared. A post-operative panoramic radiograph (Fig. 2) was taken three days later, and the root fragment was detected at the supero-medial region of the right maxillary sinus at the level of the middle/inferior concha. A Waters' radiograph was then prescribed, but the location of the root fragment cannot be clearly identified. After the surgeon's initial interpretation, a Caldwell–Luc operation was attempted to retrieve

the root, but the root fragment could not be found within the sinus. Consequently, a cone-beam computed tomography (CBCT) examination was ordered to re-evaluate the exact location of the root fragment. On the CBCT scan, the 4.88 mm in its largest diameter root fragment was shown in the superior portion of the right nasolacrimal duct near the orbital floor (Fig. 3). The bone perforations at the lateral wall of the right nasal cavity and the medial wall of the right maxillary sinus were 5.00 and 2.42 mm in size, respectively (Fig. 4). Because of these findings, the patient was referred to an ophthalmologist for proper management of possible secondary acquired lacrimal drainage obstruction.

## 3. Discussion

The development of the maxillary canine begins within a complicated area of facial bones, surrounded by the orbit, the nasal cavity and maxillary sinus [22]. If impaction occurs, the canine's root can be found deep in the maxilla among those structures. In addition, the prevalence of dilacerated roots is common – reported to be 26–57% [23,24], while few studies described post-operative nasal wall perforation as a complication due to root apex proximity or intra-operative surgical procedure [25,26]. Hence, surgical removal of impacted maxillary canine should be carefully considered to avoid intra- and post-operative complications. In order to achieve this goal, precise tooth localization is crucial. In more than 60% of cases, it is possible to decide whether the crown of the impacted tooth is facial or palatal using palpation [27]. In other cases, radiographic assessment is needed for effective localization [15].

A conventional two-dimensional (2D) radiograph is commonly acquired to investigate location of the impaction. Panoramic radiography is usually prescribed to determine angulation, mesio-distal position, depth of impaction, and the relationship with adjacent structures. However, diagnosis and treatment planning based on 2D imaging is difficult and prone to misinterpretation due to structural superimposition, image magnification and image distortion. Three-dimensional modalities not only offer precise location of impacted maxillary canines, but also show root configuration and dimension, associated pathologies, root proximity and availability of surrounding bone, allowing for proper treatment planning [28,29]. Moreover, if any complication occurs, detailed information of structures in complex anatomical areas can be properly visualized, including bone perforations, location and size of fractured parts and their distance to surrounding landmarks.

In our case, the root fragment, dislocated into the nasolacrimal duct, was not immediately recognized from conventional radiographs. Despite the fact that the post-operative panoramic radiograph (Fig. 2) revealed the root of interest within the sinus outline at the mid-sinus level closing to the antero-medial antral wall, it was in an unusual location within the sinus considering the force

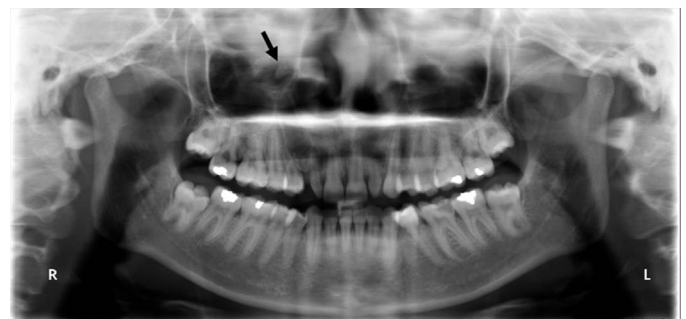


Fig. 2. Panoramic radiograph showing the root fragment (arrow) by the medial wall of the right maxillary sinus.

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