

Original Article

A clinical analysis of 11 mandibular impacted canines

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Abstract: This study aims to investigate the clinical features and treatment of mandibular impacted canines. From May 2013 to May 2018, 11 patients with mandibular impacted canines and complete imaging and records were recruited in the study. The 11 patients had a total of 14 impacted teeth. The study aimed to analyze the incidence, treatment methods, and results of mandibular impacted canines in both genders, as well as the occurrence of complications. Of the 11 patients, 3 were male and 8 were female. Among them, 3 patients had bilateral mandibular impacted canines. One patient had 4 impacted canines in the upper and lower mandibles. Among the 14 teeth, 7 were found to have migratory impacts, 3 were accompanied by dental cysts, and 1 was accompanied by cystic sarcoma. All the teeth were removed by bone expose. Mandibular impacted canines are more common in women. Generally, the position is deep, and some are horizontal. They are prone to migration and can be associated with various periodontal diseases.

Keywords: Impacted canine, transmigrant canine impaction, dentition, dental cyst

Introduction

Impacted teeth are defined as teeth that remain completely or incompletely embedded in the jawbone or mucosa for more than 2 years following their physiological eruption time [1]. There are wide variations in impacted teeth among individuals, and third molars remain the most prevalent impacted teeth, followed by maxillary canines [2]. The incidence of impacted and transmigrant mandibular canines in the mandible is not as high as that in the maxilla. In fact, the prevalence of impacted mandibular canines in a large group of southern Chinese children and adolescents was found to be 0.3% [3]. Unfortunately, it is difficult to find clinical guidelines derived from sound studies based on large patient samples [4]. The potential of the maxillary canine for impactions and eruption guidance facilitated by the lateral incisors is controlled by genetics. Therefore, the developmental stage of a tooth has a key role in guiding the ultimate positions of canines and malocclusions [5]. Hence, the detailed assessment of

an impacted tooth for its location, angulation, and orientation is important for orthodontic treatment planning. For this purpose, a variety of radiographic assessment tools has been used to evaluate impacted canines [6]. Maxillary canine implantation is more common in clinical practice, but mandibular canine implantation is relatively rare [7]. Most of the patients have irregular dentition, have an adequately wide but shorter lower dental arch forming along with a wider mandibular total tooth size and a greater arch-length-tooth-size discrepancy [8]. Oral imaging examinations before orthodontic treatment have found that the most commonly-performed treatment for the correction of an impacted mandibular canine is surgical removal of the impacted tooth [9]. The transmigration of a mandibular canine is a rare anomaly of eruption [10], which increases the treatment complexity in terms of both anchorage and biomechanical planning [11]. The clinical data of 11 patients with mandibular impacted canines admitted to our department from May 2013 to May 2018 were retrospectively

Table 1. The locations and types of 14 mandibular canine impactions in 10 patients (cases)

Location	Impaction	Transmigrant impaction	Sum
33	3	2	5
43	4	5	9
Sum	7	7	14

analyzed, and we sought to describe their clinical characteristics. The report is as follows.

Materials and methods

Clinical data

A total of 11 patients were admitted to the dental clinic of Yan'an Hospital, Kunming, from May 2013 to May 2018 for the treatment of dentition irregularity. The patients underwent a conical beam CT (CBCT) and were diagnosed with mandibular canine impaction. All the patients had complete imaging and hospital records, and a total of 14 teeth were studied. This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Yan'an Hospital. Written informed consents were obtained from all participants.

Imaging data collection and observation

One full-digital oral CBCT instrument (Kavo iCAT 17-19, Biberach, Germany) was used for full-thoracic scanning. The scanning field of view was 16 cm × 13 cm, and the range was complete maxillary and mandibular dentitions, as well as complete maxillary and mandibular alveolar bones. The raw data were transformed into the digital imaging and communication in medicine format (file format: DICOM) for processing and observation using In Vivo Dental 5 (GENDEX Dental Systems, Des Plaines, USA). Images read from a variety of sections (such as the sagittal section, coronal section, horizontal section, arbitrary section, or curved section) were selected for the analysis.

Results

The 11 patients, including 3 males and 8 females (72.7%), ranged in age from 13 to 30 years old. The CBCT imaging data showed that all the 14 teeth were completely impacted (**Table 1**). Among the patients, 3 patients had

bilateral mandibular canine impaction, 7 patients had transmigrant impaction (**Figure 1**), and 3 patients had dental cysts (**Figure 2**), among whom one patient was accompanied by a dental tumor (**Figure 2**).

One patient had four maxillary and mandibular impacted canines (**Figure 3**), which were removed in one surgery simultaneously (**Figure 4**). Firstly, the incision of the gingival flap was used to expose the mandible, and then one rounded bone fenestration was performed to expose the impacted tooth. The crown was then split and removed by T-type dissection, followed by tooth root surface drilling, as well as root lift and removal. After the tooth was removed, the alveolar socket was exposed, and the incision was then sutured.

Discussion

The impaction of anterior teeth not only affects the appearance of the dentition but also affects the normal function of the oral cavity. Theoretically, the impaction of canines can occur in the upper and lower jaws. However, previous clinical observations and related studies have shown that canine impaction occurs mostly on the lateral side of the maxillary ridge [12], which can occur unilaterally or bilaterally and occurs more often in females than males [13]. Walker et al. [14] attributed the above gender difference to the difference in craniomaxillofacial growth between males and females, and to the fact that women have higher requirements for beauty.

The incidence of maxillary canine impaction is 1.5%-2.2% in the general population, and the incidence of mandibular canine impaction is only 1/5 of that of the maxillary canine. It was once reported that the incidence of maxillary premolar impaction is higher than that of mandibular canine and premolar impaction. It is believed this occurs because of the anatomy of the upper and lower jaws and the eruption order of teeth. The eruption order of mandibular teeth is such that the canines erupt earlier than the premolars, or the first premolar is earlier than the canines and the second premolar. Therefore, the impaction of mandibular canines and the first premolar occurs less frequently than the second premolar [15].

All the patients in this study were orthodontic patients. Clinical examinations revealed the

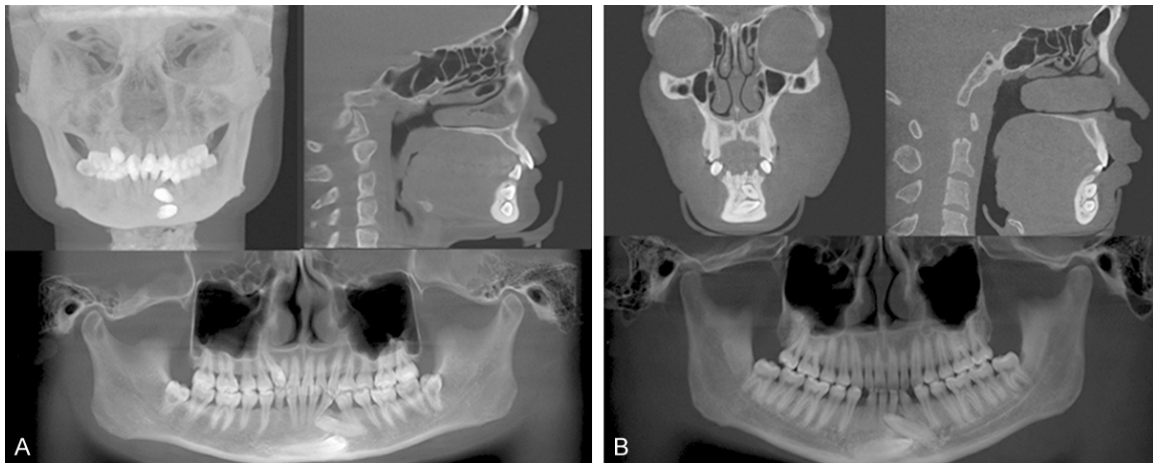


Figure 1. Image of a transmigrant impaction. A. 43 transmigration and impaction, horizontally lying on the mandible. 43 has crossed the midline, 33 has a tendency to transmigration and impaction but is unable to cross the midline with the blocking of the tooth tip of 32; B. 43 transmigration and impaction. The tooth tip of 33 has crossed the midline, but 43 lies horizontally on the mandible.

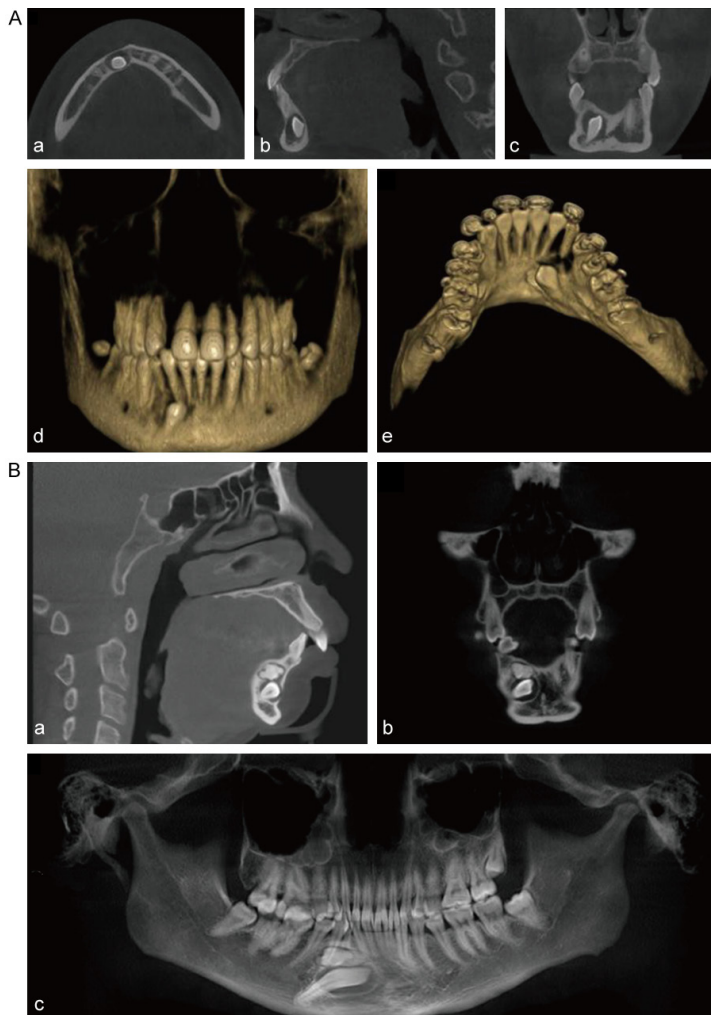


Figure 2. Image of an impaction with combinations. A. 43 accompanied by cystic odontoma. B. 43 accompanied by cystic odontoma and odontoma.

abnormal eruption of the permanent teeth, and imaging examinations revealed mandibular canine impaction. The surface fault has an obvious distortion and deformation in the anterior region, which affects the relationship between the teeth and the surrounding fine anatomical structure and can even lead to a missed diagnosis. Furthermore, the teeth in the maxillary anterior region are often outside the scanning range and can't be seen. In a commonly used imaging examination of the oral cavity, CBCT is gradually being applied as a new oral examination method in clinical practice due to the small amount of radiation it requires, its high contrast, its high spatial resolution of hard tissue imaging (especially for small bone structure details) [16, 17], its shorter scanning time, its faster imaging speed, and its lower cost, so its clinical applications are increasing more and more [18, 19]. CBCT can completely display the impacted canine through 3D imaging, thus avoiding the occurrence of a missed diagnosis; at the same time, it can accurately display the adjacent relationship between the impacted canine and the surrounding anatomy. Therefore, the

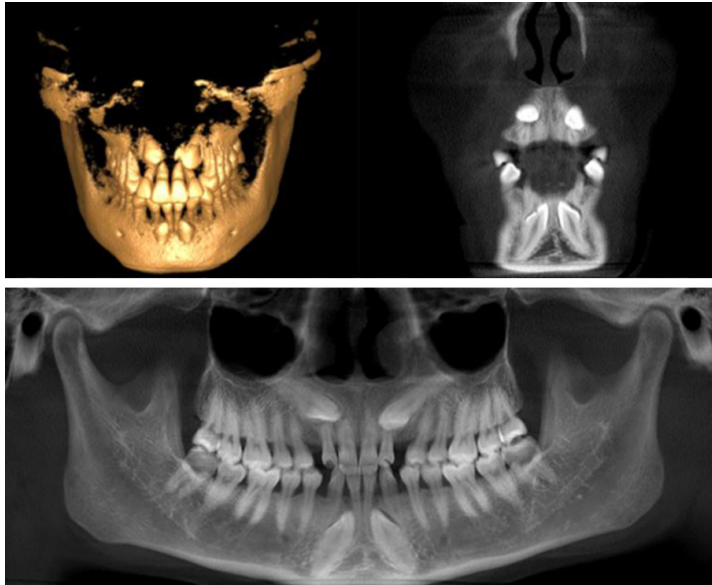


Figure 3. Four maxillary and mandibular impacted canines.

11 patients in this study underwent CBCT imaging.

In this study, the 6 patients with transmigrant mandibular impacted teeth included 5 females and a total of 7 teeth, and one patient also had a dental cyst. One patient had bilateral transmigrant mandibular canine impaction, and another patient had the right mandibular canine migrated to the left, while the left mandibular canine had a migratory tendency but was blocked by the ipsilateral mandibular incisor root so it couldn't migrate to the opposite side, so it was not classified as a transmigrant tooth.

The transmigrant impaction of the mandibular canine is also called the transmigration of the canine. The teeth are generally horizontally impacted with the crown facing the contralateral side and the tooth tissue partially or completely located below the contralateral anterior tooth or the apex. The transmigration of mandibular canine means that the mandibular canine drifts from one side of the arch to the other side during the eruption process [20], and the key is that it crosses the midline and reaches the opposite side [21].

Aydin et al. [22] retrospectively analyzed the incidence of transmigrant canines as 0.31% through 4500 panoramic images; Aktan et al. [23] analyzed 5000 panoramic images of the Turkish subgroup and reported the incidence of transmigrant canines as 0.48%. The incidence of transmigrant mandibular canines is signifi-

cantly greater than in other teeth, and the number of females with transmigrant mandibular canines is more than that of males, which is about 1.6:1.0 [24], most of which are unilateral mandibular canine transmigrations, while a few are simultaneous bilateral mandibular canine transmigration [25, 26], in which case there are normally no obvious symptoms [27]. The etiology of canine transmigration is unknown. Camilleri and Scerri [27] believe that genetic factors, dentition crowding, deciduous teeth retention, multiple teeth, an excessive canine crown, or edema may be the causes of canine transmigration, but sufficient evidence is still lacking.

Dental tumors and dental cysts are common in clinical practice, but tooth impaction combined with a dental tumor, as well as a dental tumor combined with a dental cyst, is relatively rare. Dental tumors are a type of developmental deformity of the dental tissues instead of true tumors. They are classified into mixed dental tumors and combined dental tumors. Dental tumors occur in youth and children. Combined dental tumors are more common in the anterior region and can occur in any part of the upper and lower jaw at any age during tooth development. The diagnosis of dental tumors is relatively simple, and the tumor growth is limited, so the surgical prognosis is good. The presence of both dental tumor(s) and cyst(s) is called cystic sarcoma, but there are few reports about such cases, and no clear imaging definition has been given for cystic sarcoma [28].

A dentigerous cyst, also known as a follicular cyst, is most commonly found in the third molar region of the mandible, followed by the maxillary canine region, and which may cover the crown portion of one or more teeth. The incidence of dental cysts accounts for about 24% of all odontogenic cysts occurring in the jaw, which is second only to the root cyst. Statistics indicate that, in the total population, 1.44 of every 100 unexposed teeth have dental cysts [29], but there are few recurrences after tooth cyst removal, so the prognosis is good. The combination of mandibular canine impaction with a dental cyst is occasionally reported [30].

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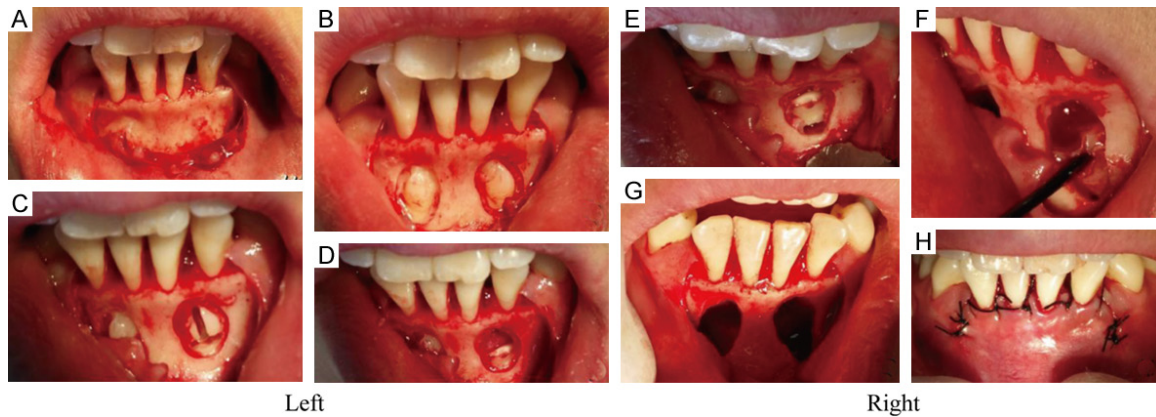


Figure 4. Left: Bilateral mandibular impacted canine extraction: (A) incision using a gingival flap, (B) rounded bone fenestration to expose impacted teeth, (C) split the crown of the tooth with T type, (D) removal of crowns; Right: Bilateral mandibular impacted canine extraction: (E) drilling on the surface of the root, (F) lifting and pushing the root, (G) alveolar fossa, (H) suturing incision.

A total of 3 patients in this study had dental cysts, all of which were located in the cystic cavity.

Due to the impact of the anatomical shape of the jaw and the order of tooth eruption, the incidence of mandibular canine impaction is low, but once it happens, the impaction location of the mandibular canine is deep, and most are horizontally impacted and are prone to migration. They also contain complex lesions such as dental cysts and abnormal tooth morphology. In most cases, the teeth have no retention value and need to be removed before orthodontic treatment.

The patients in this study were all admitted for tooth extraction, but whether the mandibular impacted canines need to be removed must take into account the patient's age, tooth age, tooth shape, dental impaction position, adjacent anatomical structure, and other factors. Preoperative imaging data analysis is particularly important. The patients in this study were analyzed by orthodontists to design a treatment plan, and the decisions to remove the teeth or not were made according to the patient's wishes and the actual situation. Tooth extraction involves time and orthodontic treatment, and the number of patients undergoing clinical surgery for the germination of impacted canines is much larger than the number undergoing tooth extraction, but the number was not included in this study's data, so it was not discussed.

All the removal operations used the labial gingival flap approach, and because the location of

the mandibular impacted canine was deep, a lot of bone removal was necessary. Therefore, this type of surgery lacks the option of a curved incision of the mandibular vestibular mucosa, for two reasons: 1. The soft tissue has no bone tissue support; 2. the surgical field can't be fully exposed.

For the exposure of the impacted teeth, the strategy of bone removal from the point to the surface was adopted, that is, one circular opening was first made in the shallow surface of the crown to expose the tooth body, which was then gradually enlarged until most of the crown was exposed. The method of T-type dissection of the tooth tissue namely cut the tooth into two parts at the neck of the tooth, and then cut the crown into two parts along the longitudinal direction. After successfully removing the crown, the root of the tooth can be loosened; however, the root of the impacted canine usually has no gap with the surrounding bone tissues, and it is impossible to place the dental elevator, so it is necessary to enlarge the circular opening of the bone, toward the root direction, to the ovate shape so as to expose partial root tissue, followed by drilling a circular hole in the root surface, inserting the dental elevator into it, and pushing and lifting the root to the crown. This method can avoid hammering, reduce the amount of bone removal, and effectively protect the adjacent teeth.

For the traction effect of the opening toward the mandibular impacted canine, a sufficient treatment period is still needed for long-term observation and comparison so as to evaluate

the effect. Currently, such relevant clinical cases are still rare, so no relevant discussion has been made.

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Disclosure of conflict of interest

None.

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