How 3D Imaging is Superlative to 2D Imaging in Diagnosis of Canine Impaction: A Case Report

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Abstract

A case was presented with unilateral impaction of maxillary canine, the prognosis was favourable on both clinical and two dimensional radiographic diagnosis. On clinical examination the tip of the canine was visible and buccally palpable in the oral cavity, and the OPG examination showed an intact impacted canine tooth. During the surgical exposure of the impacted canine slight mobility was observed and this led to the decision of going for a CBCT investigation. On CBCT evaluation, an internal pathology affecting the crown portion of the canine was revealed which led to the decision of surgical removal of the impacted canine. This proves that CBCT- a 3D imaging technique play a critical role in revealing hidden findings which changes the diagnosis and treatment plan completely.

INTRODUCTION

Tooth eruption is a physiologic process that occurs in association with the normal development of the alveolar bone. The impaction of a tooth may hinder the normal development of the alveolar bone of that particular region. Abron et al defined impaction as retardation or halt in eruption.[1] Lindauer et aldefined a canine as being impacted if it was unerupted after complete root development or if the contralateral tooth was erupted for at least 6 months with complete root formation.[2] Canine impaction is considered as an unerupted tooth when its root development is complete. Maxillary permanent canine has a long and winding eruption path, which is slightly buccal to the dental arch. They are the second most impacted and ectopically erupting teeth. Moreover, its eruption occurs after the eruption of lateral incisor and first premolar. Hence, any approximation between the roots of these teeth decreases the space available for the eruption of canine and may lead to its intraosseous retention or ectopic eruption, usually expressed by an exaggerated buccal position.

PREVALENCE

Maxillary canine impaction-0.92-2.2%; Mandibular canine impaction- 0.35%; Gender –F:M - 2:1; Palatal: labial :3:1/2:1; Palatal-85%: buccal-15%; Unilateral: bilateral-4:1; Unilateral-92%: bilateral-8%; High incidence in Turkish population 3.29%; Lowest in Japanese population; Caucasians: Asians-5:13.
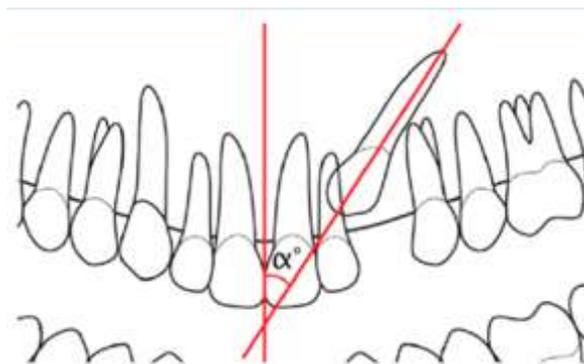
DIAGNOSIS

The main purpose of radiographic imaging in orthodontics is to supplement, clinical information auxiliary to the clinical diagnosis of skeletal and dental conditions, soft tissues and dento-maxillofacial inter-relationships.The in-built limitations of 2-D radiography for assessment in maxillofacial orthopaedics and orthodontics have been rec-ognized for decades. Lateral cephalometric radiography exhibits merely a composite of antero-posterior and vertical relationships and limited information on unilateral or transverse aspects of malocclusions or craniofacial anomalies. For decades, the only true three-dimensional documentation was plaster study casts of the dental arches. Dental and maxillofacial cone beam computed tomography(CBCT) is a quick acquisition technology that marks a shift in extra-oral radiography from representative 2D images to a 3D which is anatomically accurate, volumetric dataset, broadening the role of imaging in orthodontic diagnosis.[4] Diagnosis of canine impaction mainly consist of two methods:

1. Clinical examination

2. Radiographic examination

Radiographic examination involves periapical radiographs, occlusal radiograph (true occlusal or vertex occlusal), extra-oral radiographs, CT scan and CBCT.[5,6] Analytical methods for impacted canine is sector location of the cusp tip which was used to determine the position of the tooth. Sector location is a consider ably superior predictor of impaction than tooth angulation. The angle formed by the long axis of the impacted maxillary canine with the midline is called "Alpha" (figure 1) and the angle formed by the long axis of the maxillary canine on the antimere side is called "Theta".[7]

(figure 1)

CASE REPORT

PATIENT HISTORY, CLINICAL EXAMINATION, DIAGNOSIS

This is a case report of 19years and 7months old female patient who reported to the department of Orthodontics with a chief complaint of irregularly placed upper and lower teeth. She has a past dental history of using expansion appliance from department of Pedodontics. On extraoral examination, the patient had apparently symmetrical vertical thirds and orthognathic profile (figure 2).

On intraoral examination, patient had a Class II Div II incisor relation and a class I canine relation on right side. The molars are incross bite on left side and are buccally placed on right side. The patient had upper anterior spacing and lower anterior crowding, partially impacted 23, cross bite in relation to 26. The left maxillary canine can be palpated clinically (figure 3).

Figure 2

Figure 3

A panoramic radiograph revealed that, the maxillary canine was erupting into the middle third of the root of the maxillary central incisor. The apex of the left maxillary canine cannot be identified in the OPG because of the overlapping of the maxillary sinus (figure 4).

Advanced imaging technology such as computed tomography was not taken at the time of initial clinical examination because the crown tip was visible at that time. Based on the information obtained from the clinical examination and 2D radiographs, the patient was advised to initiate orthodontic treatment because of the favorable position of the maxillary canine.

TREATMENT OBJECTIVES

1. Disimpact the labially positioned maxillary canine into the dental arch.

2. Correct the crossbite in relation to 26.

3. To correct lower arch crowding

4. To correct upper anterior spacing

5. Reduce the deep anterior overbite.

6. Achieve most ideal esthetics and occlusion possible in a reduced treatment time.

TREATMENT PLAN

On case discussion, it was decided for a non-extraction line of management with fixed appliance therapy. Pre-adjusted edgewise appliance with MBT bracket prescription (0.022"slot) was selected for treatment. Since the patient had buccally placed maxillary right first molar and palatally placed maxillary left first molar, initially it was decided to give a transpalatal arch to correct the molar position by bringing it into the dental arch. This was followed by levelling and alignment of teeth and disimpaction of partially impacted maxillary left canine.

TREATMENT PROGRESS

On the first day of appointment, bonding was done on maxillary teeth from right second premolar to left second premolar. Since the patient had abnormally positioned maxillary molars, arch wire was not placed; instead ligature wire consolidation was given to the bonded maxillary teeth. To bring the molars into the arch, active transpalatal arch with bands was cemented on to the maxillary permanent first molars. After 3 weeks, patient was recalled, TPA was activated and 0.014"

Figure 4

NiTi was placed on maxillary arch (figure 5).

At the same appointment, patient was advised to do gingivectomy on the partially impacted maxillary left canine to expose the crown portion for the placement of an attachment to bring it into the arch. On taking a CBCT, internal crown pathology was noted in relation to maxillary left canine. The sagittal section of coronal portion of maxillary canine showed there is only a shell of enamel present over the crown (figure 6). The internal region of crown was occupied by soft tissues and it lacked dentin (figure 7). The force application by fixed orthodontic therapy was contraindicated due to the weak coronal structure. Therefore, surgical removal of the tooth was indicated (figure 8).
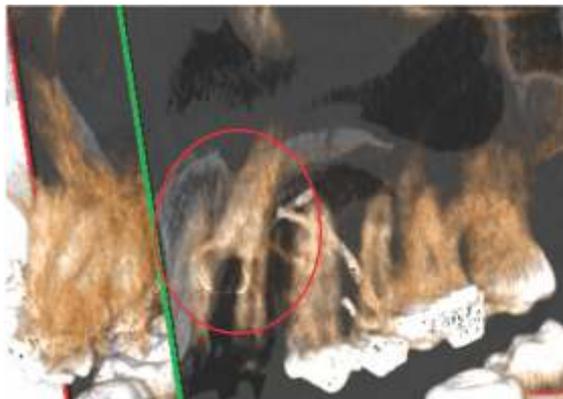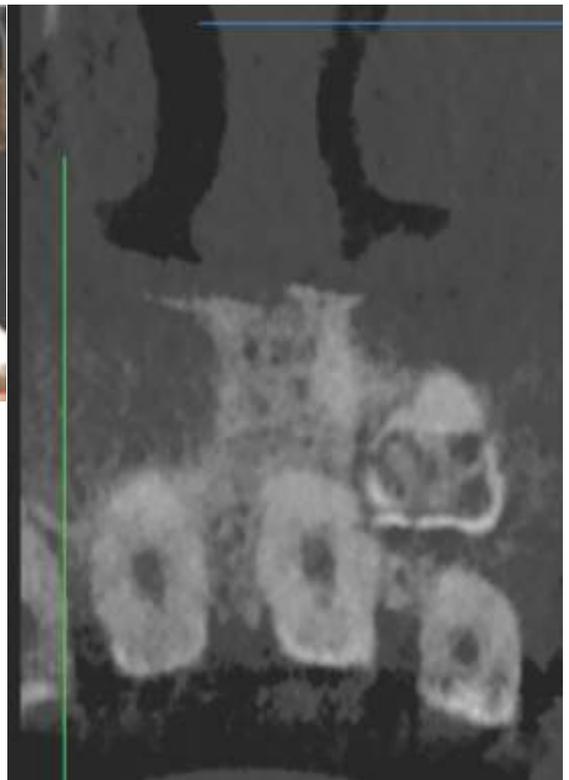

Figure 5

Figure 6

Figure 7

RESULT

The CBCT revealed a malformed crown in relation to partially impacted maxillary left canine and the patient underwent the surgical removal of the same, because the tooth was not favourable for fixed orthodontic treatment. So, this case confirmed that, all cases of canine impaction even though the impacted canine can be palpated labially or lingually, require additional diagnostic aids like CBCT for identifying the position of root apex, morphology, hard and soft tissue pathologies etc.

Initially, in this case, the canine was considered as favourable for eruption and also have normal crown & root morphology based on the information that we obtained from the clinical examination and two dimensional radiographic methods. The 2D radiographic methods revealed that, this case has good prognosis. But the real picture was revealed only after taking CBCT. The 3D imaging technique examines the tooth in all 3 dimensions and helps us to identify the coronal pathology in relation to the impacted maxillary canine.
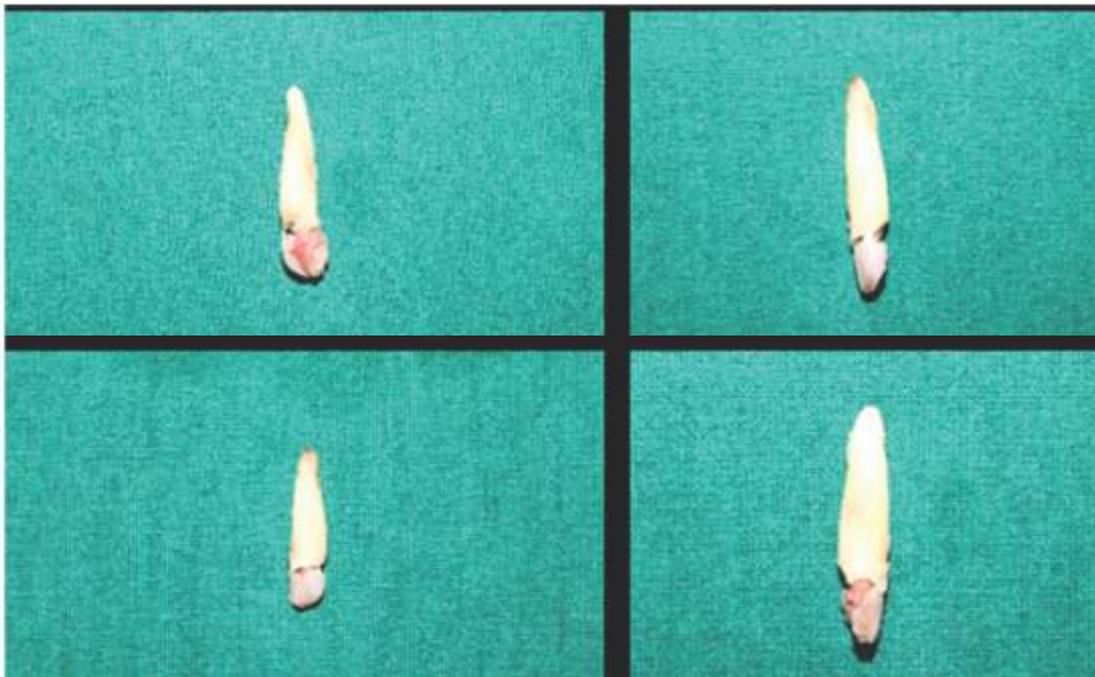

Figure 8

Figure 9

DISCUSSION

Permanent maxillary canines are the second most commonly impacted teeth, after third molars. Maxillary canine impaction occurs in approximately 2 percent of the population and is twice as common in females as it is in males.8The incidence of canine impaction is twice more in the maxilla than the mandible. Of all patients who have impacted maxillary canines,[8] percent have bilateral impactions.[9] Approximately one third of impacted maxillary canines are located labially, and two-thirds are located palatally.[10]

Canine impaction can be caused by various factors. The palatally displaced maxillary canines have an unknown etiology. The results of Jacoby's study showed that 85 percent of palatally impacted canines had sufficient space for eruption, whereas only 17 percent of labially impacted canines had sufficient space.[11] Therefore, the primary etiologic factor for labially impacted canines are the arch length discrepancy. The etiologic factors responsible for canine impactions may be divided into two main groups. First, there are local factors, such as an increase in bone deposition, trauma, malposition or malocclusion of adjacent teeth, prolonged retention of primary teeth, premature loss of primary teeth, and local pathosis. A second group involves systemic factors, such as childhood diseases, ankylosis of the temporomandibular joint, hereditary factors, syphilis, cleft palate and cleidocranial dysostosis.[12]

Because of close proximity of canine to the incisor roots there is a buccally directed force occurs, this will lead the canine to contact the roots and may cause damage. Moreover, the canine position may not improve due to the root obstacle. The surgical removal of an impacted maxillary canine is rare, as the risk exists that it may affect esthetics and occlusion. However, if the canine has limitations due to its location or is severely affected anatomically, extraction may be the only option.[13]

The present case demonstrated the significant advantage of the use of CBCT in cases of impacted canines. If an impacted canine is resorbed, the patient would be unaware of a problem withthe use of conventional X-rays, even if the root is already resorbed to such a greater degree. Therefore, early detection is of the greatest importance and is now possible through the application of CBCT.

CONCLUSION

This case report suggests that, early diagnosis and interception of impacted canines results in a successful esthetic and functional outcomes. It is important for an orthodontist to be aware of normal canine development and associated dental anomalies. Early recognition is possible with conventional radiographic methods, but accurate diagnosis is only achieved through a 3D imaging modality. In this way, 3D imaging is superlative to 2D imaging in orthodontic diagnosis.

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