



# An examination of CBCT results for ectopic cuspid impaction: a case report

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## ABSTRACT

**Objectives:** This case report aims to examine the image of an ectopic canine impaction using cone beam computed tomography (CBCT).

**Case Report:** A 23-year-old man came to our hospital with complaints of irregular, spaced teeth and a protruding sensation in his gums. There was no history of systemic disease. CBCT examination was performed. Multiplanar reconstruction showed the position of the impacted canine tooth with the crown facing labially and the root facing palatally. The position of the canine tooth caused the crown and root to penetrate the buccal and palatal cortical bone surfaces.

**Conclusion:** CBCT 3D effectively assesses the position of the impacted canine tooth, including its crown and root, and evaluates its relationship with surrounding structures. This assessment is crucial for determining treatment prognosis, as conventional radiography may misinterpret the tooth's position.

**Keywords:** Cone-beam computed tomography, cuspid, ectopic, impacted

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## INTRODUCTION

Arch length differences, irregular eruption routes, or developmental abnormalities primarily cause impacted canines. A precise clinical and radiographic evaluation is essential to determine the best surgical, orthodontic, or combined solution.<sup>1,2</sup> With a reported prevalence of 0.3–1.35%, maxillary impaction is more common than mandibular.<sup>3,4</sup> In terms of function, canines are essential for disocclusion during excursive motions.<sup>4</sup> To avoid difficulties, early assessment and possible removal are crucial.<sup>5,6</sup> By age ten, Ericson and Kuroi recommend palpating the maxillary canine in the buccal sulcus; if not, a positional evaluation should be considered.<sup>6</sup> Accurate localization and early identification of impacted canines are crucial to prevent complications like root resorption in surrounding teeth, which can affect long-term prognosis.<sup>7</sup>

Radiographs aid in their classification and detection.<sup>6,8</sup> Conventional two-dimensional (2D) radiographs, such as panoramic, occlusal, and periapical images, are the primary tools for diagnosis and treatment planning. However, a limitation of 2D radiographs is that maxillary canines often overlap with the roots of incisors, complicating the assessment of root resorption in the buccal-palatal direction.<sup>9,10</sup> Previous studies have shown that precise localization of impacted canines and detection of root resorption using

three-dimensional (3D) radiographic techniques can significantly influence treatment planning. Cone-beam computed tomography (CBCT) has become widely used due to its ability to provide high-quality 3D images with minimal distortion.<sup>6,8,11,12,13</sup>

Although CBCT has been widely used in orthodontics and oral surgery, reports focusing on its diagnostic contribution in specific cases of ectopic canine impaction remain limited. This case highlights the diagnostic value of CBCT in accurately localizing an ectopic impacted canine and illustrates how such detailed imaging can assist clinicians in planning effective treatment strategies. CBCT offers several benefits over conventional radiography when evaluating ectopic impacted canines. First, CBCT's accurate 3D positioning data allows dentists to determine the canine's location relative to important anatomical features such as the maxillary sinus, labial/palatal cortex, and incisor roots. Second, CBCT helps identify associated conditions such as ankylosis, root dilacerations, and root resorption of nearby teeth that are sometimes invisible on 2D imaging. Third, CBCT enables more precise surgical planning, including palatal and labial approaches, and the determination of the orthodontic traction vector. Consequently, CBCT improves treatment outcomes, lowers the risk of complications, and improves diagnostic precision.<sup>14</sup>

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CASE REPORT

A 23-year-old man visited the Dental and Oral Hospital, Universitas Sumatera Utara, with complaints of irregular, spaced teeth and gum protrusion for a year. He had no history of systemic disease, trauma, or tooth extraction, and no prior dental treatment. Clinical examination showed spacing in the maxillary anterior region, absence of tooth 23, and a localized palatal protrusion indicative of an unerupted canine. Extraoral findings were normal with no signs of infection. Symptoms began a year prior and included progressive palatal protrusion and irregular alignment. Clinical and radiographic evaluations, including cone-beam computed tomography

(CBCT), were performed for further assessment. The results of a 3D CBCT radiograph showed a radiopaque image resembling tooth 23, located within the alveolar bone between the lateral incisor and the first premolar.

The impression was that tooth 23 was impacted with a labial crown and palatal root. The radiodiagnosis of impacted tooth 23 was type VII, according to the Yamamoto classification, where the impacted canine is labio-palatal (ectopic) with the crown buccal, and type H, according to the Ghoneima classification, where the impacted canine is horizontal, close to the inferior wall of the maxillary sinus, with the crown buccal, or between the lateral incisor and the first premolar.

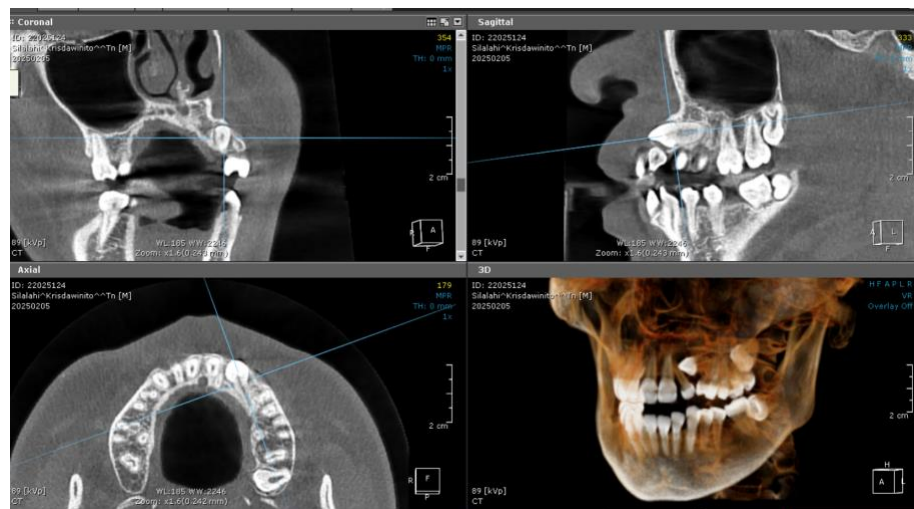


Figure 1. Multiplanar reconstruction view of tooth 23

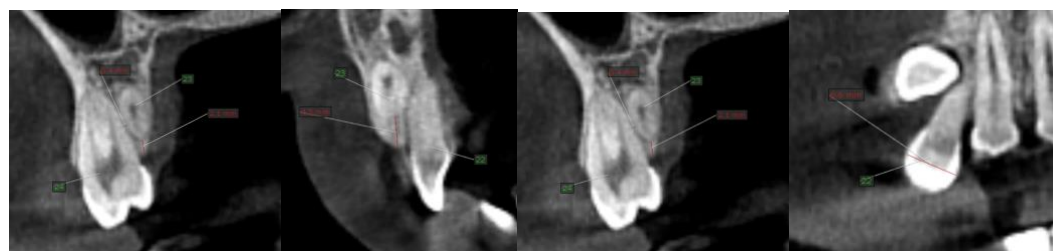


Figure 2. Coronal view. Tooth 23 appeared labial to tooth 21, 4.3 mm from the alveolar crest, and palatal to tooth 24, 0.5 mm and 2.1 mm from the crest. The mesiodistal width of tooth 22 was 6.6 mm

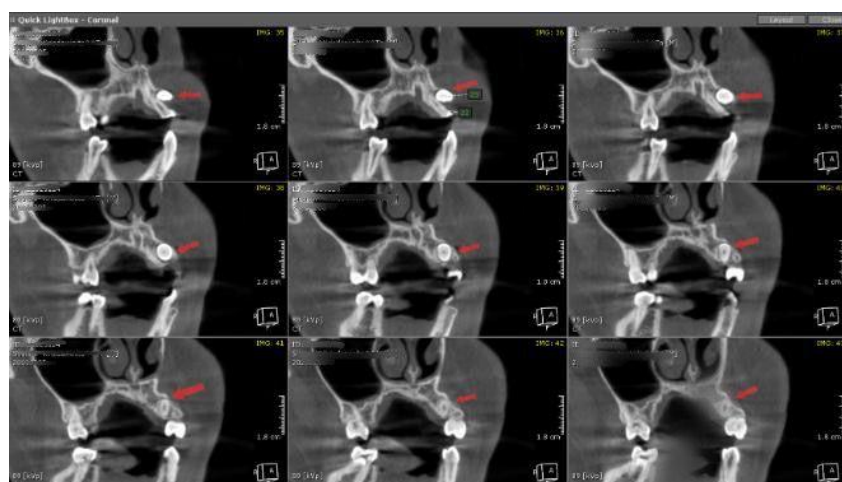
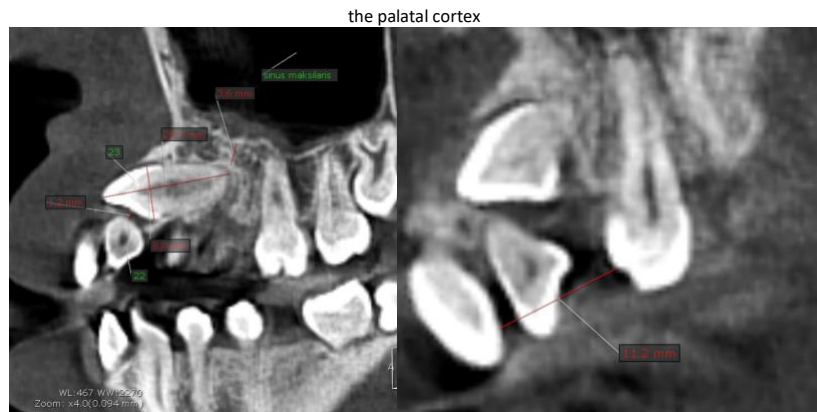
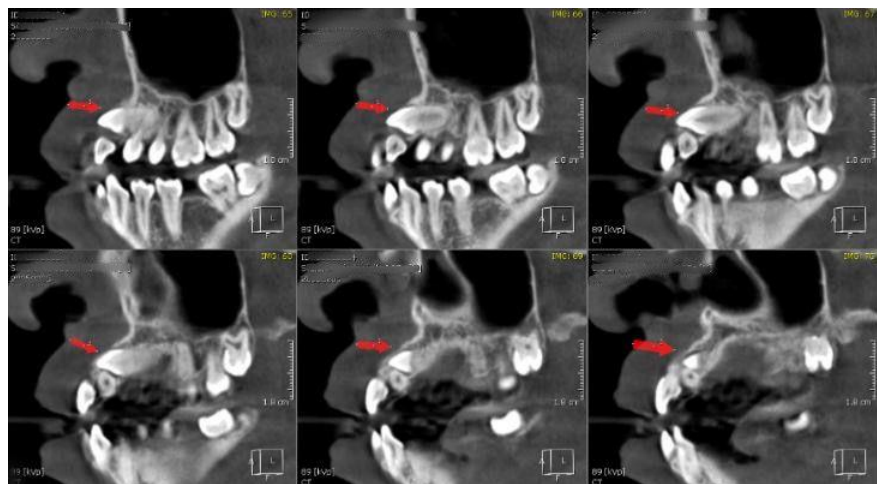


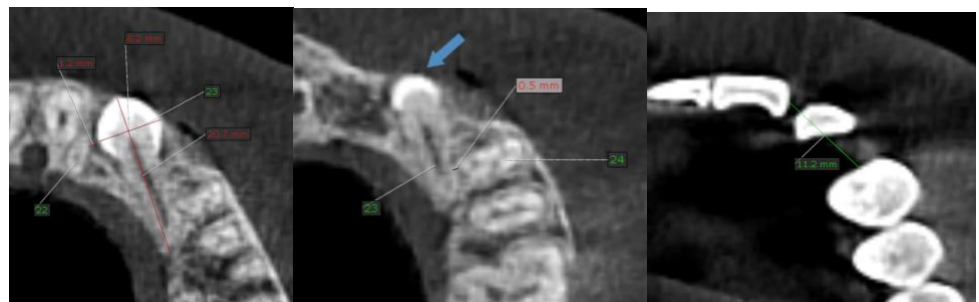
Figure 3. Coronal view slicing. Slices 35–37 showed the crown, 38–40 the root penetrating the labial cortex, and 41–43 the root contacting



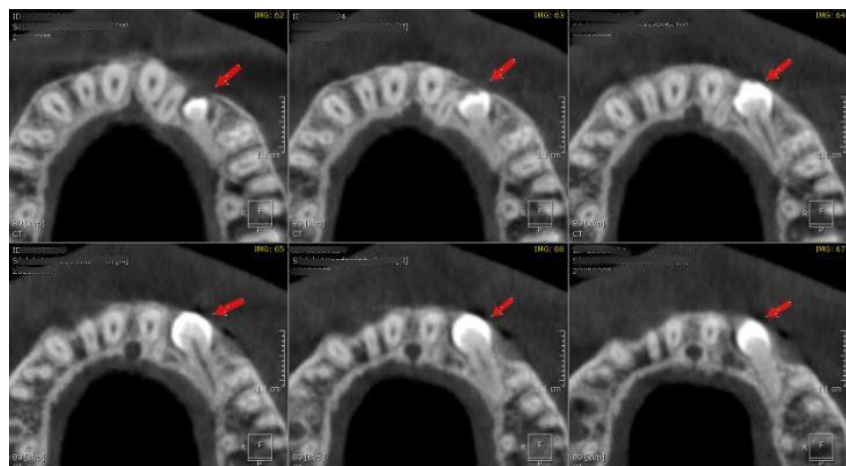
**Figure 4.** Sagittal view. The crown of tooth 23 was labial to tooth 22, with a width of 8.8 mm and a length of 20.7 mm. Apical distance to the sinus base was 3.6 mm, to the root of tooth 2 was 1.2 mm, and from tooth 21 to 24 was 11.2 mm



**Figure 5.** Sagittal view slicing. Slices 65–68 showed the crown penetrating the labial cortex; 69–70 showed the crown of tooth 13 contacting root 22



**Figure 6.** Axial view. Tooth 23 was labioversion, with a crown 1.2 mm labial to 22 and an apex 0.5 mm palatal to 24. The distance from tooth 21 to 24 was 11.2 mm



**Figure 7.** Axial view slicing. Slices 62–67 showed the crown and apex penetrating the labial and palatal cortex. Slices 63–64 showed the crown contacting root 22

## DISCUSSION

Accurate imaging is crucial in cases of canine impaction to precisely locate the impacted tooth and plan effective treatment. CBCT offers detailed 3D views for a thorough assessment of the tooth's position relative to surrounding structures.<sup>15</sup> This aligns with Faisal et al. (2024), who highlighted CBCT's effectiveness in revealing complex anatomical relationships, especially regarding the maxillary sinus and nasal cavity.<sup>16</sup> Ectopic eruption is more complex than conventional cases and can lead to root resorption. In this instance, CBCT revealed tooth 23's crown in contact with root 22 and near the sinus floor, heightening risks of resorption and treatment complications. Chaushu et al. (2015) found that a closer proximity of the canine crown to the lateral incisor raises the risk of root resorption. Similarly, Yilmaz et al. (2023) noted that unilaterally impacted maxillary canines can lead to morphological changes in adjacent teeth due to pressure and positional interference.<sup>17,18</sup>

CBCT provides vital information on tooth dimensions and proximity to critical structures. In this case, tooth 23 was 20.7 mm long and only 3.6 mm from the maxillary sinus floor, which is crucial for surgical planning and anticipating complications like sinus perforation.<sup>5,11</sup> Arisandy et al. (2024) highlighted the importance of CBCT in assessing complex impactions and anatomical relationships not visible in 2D imaging.<sup>5</sup> Canine impaction is often asymptomatic and discovered during orthodontic evaluations. Malposition can cause aesthetic and biomechanical problems, with prognosis influenced by vertical position, i.e., how deep the canine is positioned in the bone; the  $\alpha$  angle, i.e., the angle between the canine axis and the midline; and the impaction sector, i.e., the location of the impacted canine.<sup>19</sup> In this case report, the impacted canine was in the bone with an  $\alpha$  angle of nearly 60-90° and was located in sector 3, i.e., between the midline and the mesial (front) line of the lateral incisor. Treatment in this case is more complex, requiring orthodontic and surgical considerations. Park et al. (2018) found that a larger  $\alpha$  angle and a posterior sector resulted in longer and more complex treatment, with better outcomes in sectors 1 or 2 compared to 4 or 5.<sup>19</sup> Iftikhar et al. (2021) also reported that the KPG (Kemilik Position Grade) index can predict treatment duration and difficulty level in impacted canines, reaffirming the importance of radiographic assessment in treatment planning.<sup>3</sup> Canine impaction prognosis is good with low vertical position, small  $\alpha$ -angle, and sectors 1-3; moderate with intermediate parameters in sectors 2-4; and poor with high position, large  $\alpha$ -angle, and sectors 4 or 5. Poor prognosis often necessitates surgical intervention and presents higher complication risks.<sup>3,19,20,21</sup> The ectopic position of tooth 23 in contact with root 22 requires detailed spatial assessment.

CBCT allows 3D visualization of the position of the canine tooth, including the relationship of the root to vital structures such as the maxillary sinus, nasal fossa, and roots of adjacent teeth. With CBCT,

the dentist can determine the appropriate surgical approach (labial or palatal) and predict the risk of complications such as root resorption or nerve injury. This information is crucial for planning orthodontic traction and estimating treatment duration.<sup>14</sup>

The use of CBCT offered a detailed three-dimensional view for accurate diagnosis, reducing iatrogenic risks, and aiding in evidence-based decision-making. This case report focuses on imaging findings without addressing treatment. CBCT is recommended as the preferred imaging modality for evaluating complex or ectopic canine impactions, especially when nearby anatomical structures may be affected.<sup>2</sup>

## CONCLUSION

CBCT 3D effectively assesses the position of the impacted canine tooth, including its crown and root, and evaluates its relationship with surrounding structures. This assessment is crucial for determining treatment prognosis, as conventional radiography may misinterpret the tooth's position.

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## FOOTNOTES

All authors have no conflict of interest to declare for this article. Informed consent was obtained from the patient for being included in this case report.

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