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THE IMPORTANCE OF CBCT IN DIAGNOSING AND TREATMENT PLANNING OF IMPACTED CANINES - A CASE REPORT

Prosthodontics

Bisera Lazarevska Department of Orthodontics, University Dental Clinical Centre "St. Pantelejmon", Skopje, North Macedonia.

Nadica Janeva Department of Prosthodontics, Faculty of Dentistry – Skopje, Ss.Cyril And Methodius University, North Macedonia.

Vesna Jurukovska Sotarovska Department of Prosthodontics, Faculty of Dentistry – Skopje, Ss.Cyril And Methodius University, North Macedonia.

ABSTRACT

In recent years, three-dimensional Cone Beam Computed Tomography (CBCT) has become a highly valued radiographic tool in dentistry, used extensively for diagnosis, treatment planning and follow-up. 3D imaging has significantly enhanced diagnostic capabilities and improved various dental practices, from routine assessments to the in-depth analysis of complex pathologies and congenital anomalies, making the dental care more precise and reliable. In orthodontics, one of the primary applications of CBCT is in evaluating impacted canines. This article presents a case report of a patient with an impacted left maxillary canine, assessed using 3D CBCT imaging. The CBCT scan provided detailed anatomical insights, such as the labiolingual positioning of the impacted tooth, the extent of possible root resorption and its relationship with the roots of the adjacent teeth. Accurate linear and angular measurements from the CBCT images allowed for precise localization of the impacted teeth, facilitating more effective surgical exposure.

KEYWORDS

CBCT, Orthodontics, impacted canine

INTRODUCTION

The permanent maxillary canines represent the transition from the anterior to the posterior dental segment, making them important both functionally and aesthetically[1]. Generally, the upper permanent canines erupt at around 11 years in boys and 10.6 years in girls[2]. Excluding the third molars, they are the most frequently impacted and displaced teeth, with prevalence rates ranging from 1% to 3% in the general population[3]. The most common position for impacted canines is palatal (43%–87%)[4].

If left undiagnosed or untreated, impacted maxillary canines can lead to a variety of complications, including root resorption of adjacent teeth (most often the lateral incisors), aesthetic concerns, malalignment, a shortened maxillary arch, and even the formation of follicular cysts, which may result in tooth loss[5].

Given the importance of the maxillary canines, orthodontic alignment following surgical exposure is generally considered the preferred treatment for impacted canines. Alternative treatments include tooth auto-transplantation, extraction of the impacted canine with reshaping of the retained deciduous tooth, space closure, or implant-prosthetic replacement[6].

CBCT has revolutionized imaging in orthodontics by providing highly detailed, three-dimensional data, that significantly enhances the accuracy of diagnosis and treatment planning. Compared to conventional 2D radiography, CBCT offers more precise information about the location of impacted teeth, the presence of root resorption and overall treatment strategy[7]. CBCT overcomes the limitations of 2D imaging, such as positioning errors, structural overlap, image distortion and difficulty of landmark identifications[8]. The 3D helps determine the exact location of the impacted teeth and the degree of root resorption, which is invaluable during both surgical exposure and orthodontic alignment. This detailed information allows the surgeon to plan the surgical approach more effectively and enables the orthodontist to apply the correct force vector to reposition the impacted canine without damaging adjacent teeth.

The aim of this case report was to illustrate the diagnostic and treatment process for a specific orthodontic case - impaction of the maxillary canine - focusing on the use of CBCT as an essential tool. The goal was to demonstrate how CBCT provided precise information on the labiolingual position of the canine, its angulation, and its relation to surrounding structures, thereby guiding both the surgical exposure and the subsequent repositioning of the tooth.

CASE REPORT

A 14-year-old female patient presented to the Department of Orthodontics at the University Dental Clinical Centre in Skopje, with the chief complaint of a "small" canine on the upper left side. She was referred to the Orthodontic Department by her general dentist, who suspected impaction, as the patient had been seeking only reshaping of the "small" tooth.

Clinical Examination:

Upon intraoral examination, a Class I molar relationship was noted, with normal overjet and overbite, and the midlines coincided. A retained maxillary deciduous canine was present on the left side, with the permanent canine missing. Slight rotation of the upper left lateral incisor was also observed (Figure 1.)

Figure 1. Frontal view

Radiographic Findings:

A panoramic X-ray revealed an impacted maxillary left canine (Figure 2.), along with erupting third molars in both the upper and lower arches. CBCT (Cone Beam Computed Tomography) imaging was performed to determine the exact location of the impacted canine and assess the extent of root resorption in the adjacent teeth (Figure 3.).

Figure 2. Panoramic radiograph

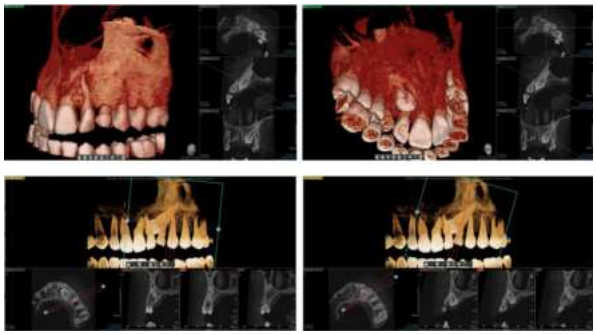

Figure 3. CBCT images used to accurately locate the position and angulation of impacted canine relative to adjacent anatomical structures

Treatment Plan:

Based on the clinical and radiographic findings, the treatment plan was outlined as follows:

1. Bonding of braces on both the upper and lower arches for alignment and levelling.
2. Extraction of the retained deciduous canine.
3. Surgical open exposure of the impacted canine.
4. Following space creation, orthodontic force would be applied to the exposed canine to guide it into the proper position in the dental arch (Figure 4.).

Figure 4. Occlusal view showing the persistence of a deciduous canine (A) and the surgical exposed impacted canine (B)

DISCUSSION

The use of Cone Beam Computed Tomography (CBCT) in diagnosing and managing impacted maxillary canines has proven to be a breakthrough in orthodontic treatment planning. In this case, CBCT provided critical insights into the anatomical positioning and angulation of the impacted tooth, as well as the root resorption of adjacent teeth, which would have been challenging to assess with conventional 2D radiographs. As demonstrated in this case report, the ability of CBCT to provide high-resolution, three-dimensional images enables a precise understanding of complex impactions, which is essential for planning surgical interventions and orthodontic treatment.

Numerous studies have highlighted the importance of early diagnosis and accurate localization of impacted maxillary canines to minimize complications and optimize treatment outcomes. In line with the findings of Peter Stoustrup et al., this case demonstrates that CBCT has an impact on the treatment planning for impacted maxillary canines and it provides factors influencing a change in the treatment plan[9].

In contrast, CBCT provides precise, 3D visualizations that allow for more accurate localization of the impacted tooth, enabling surgeons to plan safer, more effective exposure procedures. This is particularly important in cases like the one presented here, where the impacted canine's proximity to the roots of adjacent teeth was a critical consideration in treatment planning.

While CBCT offers significant advantages, it is not without limitations. One of the primary concerns is the relatively high radiation dose compared to conventional 2D radiographs. Although the radiation exposure from CBCT is still considered safe for most patients, it is essential to balance the clinical benefits with the potential risks, especially in paediatric patients or cases involving multiple scans[10]. Additionally, CBCT is an expensive diagnostic tool, which may not always be readily available in all clinical settings.

The interpretation of CBCT images also requires expertise, as misinterpretation can lead to inaccurate treatment planning. It is crucial that clinicians have proper training and experience in reading and analysing CBCT data to fully realize its benefits in clinical practice.

Given the increasing accessibility and utility of CBCT in orthodontics, future research could focus on standardizing its use for impacted canines and exploring its long-term effectiveness in improving treatment outcomes. Studies comparing the outcomes of CBCT-guided treatments with traditional methods could provide further evidence of the benefits of 3D imaging in clinical practice.

Furthermore, advancements in technology may lead to reduced radiation doses without compromising image quality, making CBCT even more beneficial in paediatric and routine orthodontic practices.

CONCLUSION

This case highlights the importance of thorough clinical and radiographic evaluation in the management of impacted maxillary canines. The use of CBCT imaging proved to be a valuable diagnostic tool, providing precise localization of the impacted tooth, its relation to surrounding structures, and the extent of root resorption in adjacent teeth. By incorporating CBCT into the treatment planning process, a more effective and individualized approach was employed, leading to the successful surgical exposure and orthodontic repositioning of the impacted canine. Early diagnosis and appropriate intervention, along with a comprehensive treatment plan, are crucial for achieving optimal functional and aesthetic outcomes in orthodontic cases involving impacted teeth.

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