CBCT-guided endodontic management of maxillary central incisor fused to mesiodens: a case report

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ABSTRACT

Objective: The aim of this case report is to present a predictable and successful solution toward the endodontic and esthetic management of a maxillary central incisor fused to a mesiodens, adopting a conservative and multidisciplinary approach. **Results:** In the present case, cone-beam computed tomography (CBCT) was helpful for endodontic diagnosis and a better understanding of the complex root canal morphology of the fused teeth.

Keywords: Cone-beam computed tomography. Image diagnosis. Fusion. Supernumerary teeth. Endodontics

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Introduction

Rigorous clinical and radiographic examinations are essential for treatment planning. Intraoral periapical radiographs are an important diagnostic tool in Endodontics for assessing the root canal anatomy. However, conventional dental radiographs may not be sufficient to understand the morphology of the root canal system. As a result of superimposition, periapical radiographs reveal limited aspects of the three-dimensional anatomy. In addition, they are subjected to geometric distortion of the anatomical structures being imaged[1]. Cone beam computed tomography (CBCT) may overcome these problems. CBCT was specifically designed to produce undistorted three-dimensional images of the maxillofacial skeleton, including the teeth and their surrounding tissues, with an effective radiation dose significantly lower in comparison to conventional computed tomography.[2,3] Potential endodontic applications of CBCT include periapical diagnosis, assessment of root canal morphology and dental trauma.[4-10]

Traumatized teeth may present a clinical challenge with regard to diagnosis, treatment plan and prognosis. Intrusion is a severe injury that affects the development of the tooth germ in children aged 0–2 years[11], which corresponds to the time of calcification of the incisal and middle thirds of the enamel matrix. The effects of trauma on primary teeth vary and include pathological and morphoanatomical changes such as fusion[12]. Fusion is defined as the union between the dentin and/or enamel of two or more separate developing teeth, an uncommon anomaly of the hard dental tissues that might cause clinical problems related to appearance, spacing and periodontal conditions. The incidence of fusion is <1% in the Caucasian population.[13] Pressure or physical force resulting in close contact between two developing tooth buds has been reported as one possible cause.[14] Genetic predisposition and racial predilection have also been reported as contributing factors in the literature.

The degree of fusion depends on the stage of tooth development at the time of fusion, with the union of dentin being the main criterion. Fused teeth might contain separate pulp canals or share a common pulp canal. Fusion might occur between two normal teeth or between a normal tooth and a supernumerary one. Supernumerary teeth in the dentition most probably result from continued proliferation of the permanent or primary dental lamina to form a third tooth germ. The most common supernumerary tooth is the mesiodens, a tooth located between the maxillary central incisors that usually has the form of a cone-shaped crown with a short root. Its incidence in the Caucasian population ranges from 0.15% to 1%, with a 2:1 predilection in males.[13]

This case report describes a multidisciplinary approach for the functional and esthetic rehabilitation of a maxillary central incisor fused to the mesiodens, guided by CBCT for better understanding of the complex root canal morphology and successful management of this rare case.

Case report

A 13-year-old female patient was referred to the College of Dentistry in Piracicaba with an esthetic complaint related to teeth # 7 and # 8 (Figs 1A and B). During the anamnesis, the patient reported being victim of intrusive tooth dislocation when she was 2 years old. The patient had an unsatisfactory composite resin restoration on the buccal aspect of the fused tooth of which original anatomy was modified. Due to the clinical and radiographic anatomical complexity of tooth # 8 (Figs 1C and D) and a non-conclusive pulp thermal test, cone-beam computed tomography (CBCT – iCat / Kavo) was requested.

The tomography suggested fusion of the upper central incisor and a mesiodens, associated with a hyperdensity in the periradicular area (sagittal section – Figs 2B and C). The analysis of sagittal sections showed a sharp palatine depression that was clinically observed after a gingivectomy. The axial sections detected the presence of two separate root canals and confirmed hyperdensity in the periradicular area (Fig 2A). The coronal view showed two separate root canals (Fig 2D). Tridimensional reconstruction provided the necessary clues for atypical access surgery in the buccal-cervical region of the dental crown (Figs 2E and F).

Buccal access and the use of a clinical microscope facilitated the localization of the two root canals with minimal dental structural removal (Fig 3A). Patency was carried out with Hi5 # 15 files (Miltex – USA), and after electronic odontometry the tooth was prepared using Flex-R manual files (Miltex – USA) and Easy

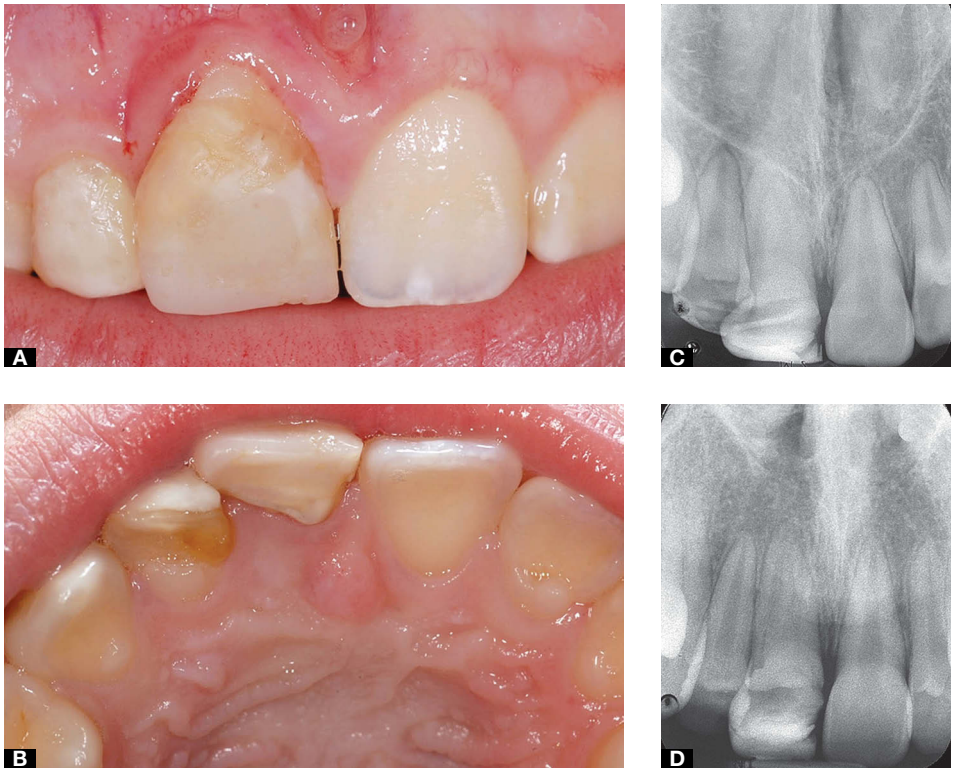

Figure 1. Preoperative photographs: **A**) labial view. **B**) occlusal view. **C**) Preoperative radiograph revealing irregular morphology of tooth 11. **D**) Off-angle angulations.

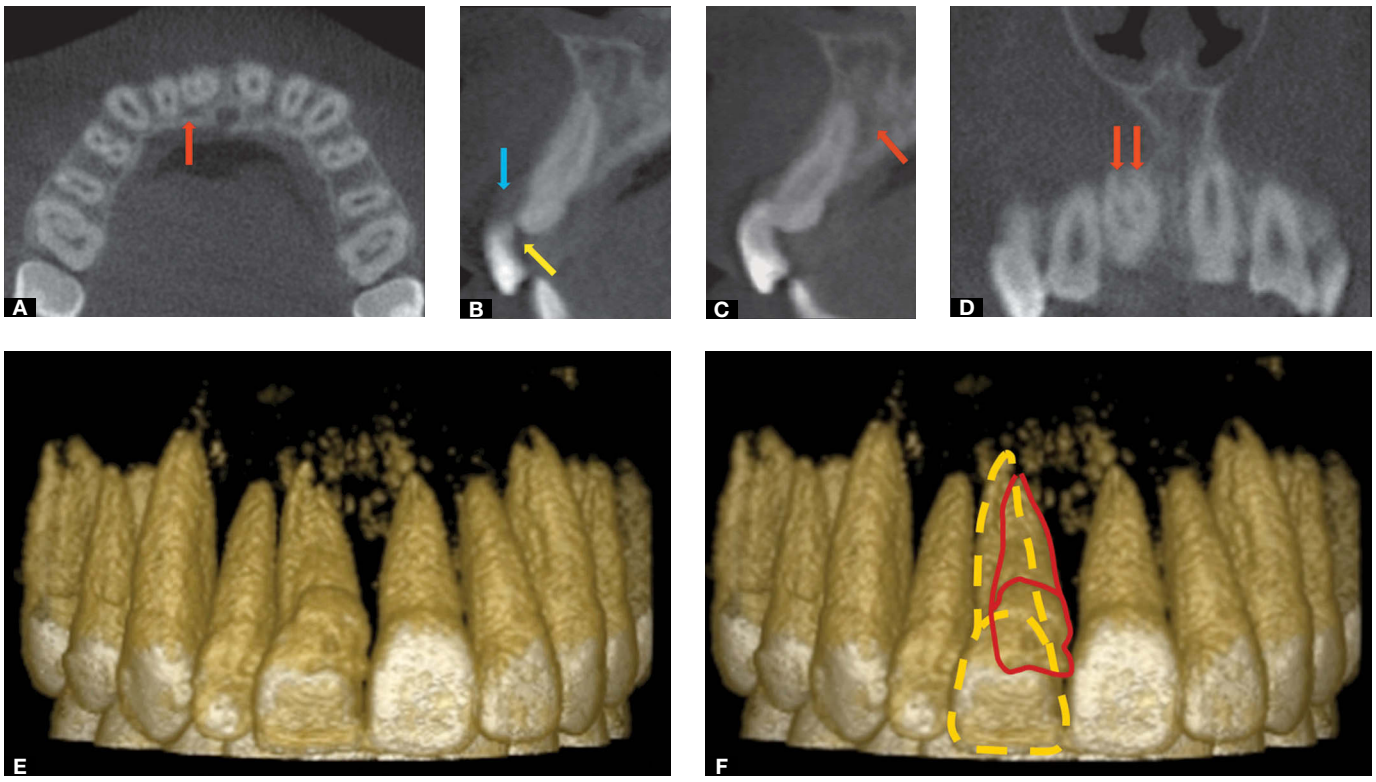

Figure 2. CBCT images of the maxilla. **A**) Axial view reveals the presence of two distinct root canals and periradicular lesion (red arrow). **B, C**) A sagittal view shows a sharp palatine depression (yellow arrow), composite resin restoration (blue arrow) and a periradicular lesion (red arrow). **D**) Coronal section shows two root canals (red arrows). **E, F**) Maxillary 3-D reconstruction shows the maxillary central incisor fused to the mesiodens.

ProDesign rotary instruments (Master Inc. – Brazil). Chlorhexidine gel (Essential Farma-Brazil) was used as an auxiliary chemical substance while saline solution was used as the irrigant (0.9% sodium chloride – Fresenius Kabi/Brazil). 17% EDTA (Dinâmica – Brazil) was used to remove the smear layer. Treatment was carried out during two appointments (Fig 3B), and obturation was performed with thermoplasticized gutta-percha and Endomethasone N sealer (Septodont – France) via the continuous wave technique (Obtura III Max Spartan Endodontics – USA).

Once the endodontic treatment had been completed, the tooth was provisionally restored with direct composite resin (Fig 3D) and the patient underwent root coverage procedures (Fig 3C).

Discussion

Intrusive injuries are the most common type of trauma during primary dentition[15] and require the dentist to carefully examine not only the damaged tooth, but also possible sequelae to the permanent tooth germ. Traumatic tooth injuries have been reported to occur mainly during early infancy between 2 and 3 years old.[13]

Fused teeth represent a striking clinical manifestation of the differentiation and morphogenetic processes of tooth development. Clinically, it might be difficult to differentiate between fusion and gemination when a supernumerary tooth is fused with a permanent tooth. However, with regard to treatment, the differentiation between fusion and gemination may not be critically important. Mader[16] has discussed the difficulty in differentiating fusion and gemination in adult dentition. He suggested that all succedaneous teeth that are joined or fused by dentin be referred to as fused teeth. Fusion of permanent and supernumerary teeth occurs less frequently than fusion between permanent teeth. Supernumerary teeth develop from a third bud arising from the dental lamina near the permanent tooth bud, or possibly from splitting of

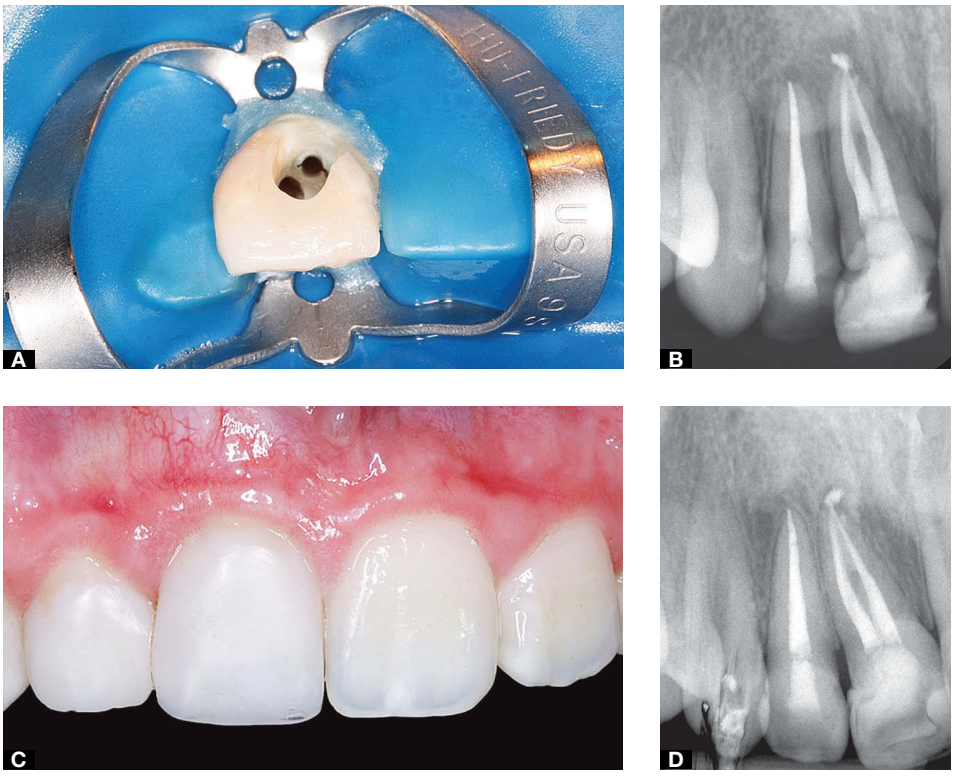

Figure 3. A) Endodontic buccal access. **B**) Periapical radiograph after canal obturation. **C**) Periodontal root coverage procedures and provisional esthetic rehabilitation of tooth 11. **D**) Periapical radiograph after provisional restoration with direct composite resin.

the permanent bud itself.[14] Fusion between supernumerary and permanent teeth occurs less frequently than fusion between other types of teeth. As far as the etiology of fusion is concerned, many theories have been proposed, including genetic factors, local metabolic interference during tooth bud differentiation as well as traumatic and inflammatory causes.[17,18]

Fusion can cause esthetic and functional problems, such as carious lesions in the grooves, particularly in the fusion zone; periodontal problems associated with the grooves that extend subgingivally; asymmetries when fusion occurs in the anterior segment; malocclusions, especially when supernumeraries are involved[18], and endodontic complications, which are frequent because of the reduced thickness of the enamel and dentin[19]. The morphology of fused teeth varies, and complex forms with separated or fused coronal pulp chambers may occur. Even separated chambers can meet in the radicular area or can remain separated.

Radiographic examinations are essential for diagnosis and treatment planning in endodontic practice. Conventional or digital periapical radiographs are often used by dentists. However, these techniques have limited value for diagnosis because the 2D images have several limitations, despite the remarkable improvements in digital radiography.[1,20] Although the use of different horizontal and/or vertical angulations[21] may provide additional information about the area of interest, sometimes this procedure may not be good enough.[22,23] Individual factors such as bone density, morphological variations, difficulty in parallel acquisitions (distortions), poor contrast, and superimposition of anatomical structures might lead to inadequate image assessment.[2,24]

In recent years, there has been a significant increase in interest in this kind of resource by clinicians, especially in more complex clinical cases, such as those involving morphoanatomic changes, in which diagnosis can be very challenging. Therefore, there is a growing need for more sophisticated radiographic tools that may provide accurate 3D information in both pre- and post-treatment assessment.[25,26]

It is important to know and communicate the dose and risks associated with CBCT in children. It is critical for healthcare providers to weigh the potential benefits of diagnostic information against the expense and risk of the imaging procedure. Some reports have suggested that CBCT examination doses are equivalent to a few panoramic exposures.[27]

In this specific case, CBCT was helpful during the diagnosis and decision-making processes for therapy. The CBCT images confirmed hyperdensity in the periradicular area and the complex morphology of the root canal system of the maxillary central incisor fused to the mesiodens. This technique showed the potential to visualize the topography of root canals and this information was invaluable in diagnosis and treatment planning. Palatal endodontic access is the most commonly used access in all situations, but due to the presence of a sharp palatine depression and composite restoration, endodontic access was achieved via the buccal surface, thus facilitating access to the root canals and minimizing the loss of healthy dental structure.

After the endodontic treatment was completed, the tooth was provisionally restored with direct composite resin and the patient was subjected to permanent esthetic rehabilitation.

Conclusion

Complex situations may be really challenging with regard to diagnosis and decision-making, thus, requiring additional resources. In this specific case, CBCT played an important role in the management of endodontic therapy leading to a predictable result.

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