Root canal treatment of a fused mandibular incisor using cone-beam computed tomography as a diagnostic aid

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Abstract

Tooth fusion consists of the union of crowns by the enamel and/or dentin. We describe a case of a patient who presented with a fistula in the apical portion of teeth 32 and 33. Clinically, tooth 32 showed increased crown width in relation to other teeth in the same arch. Radiographic examination evidenced fusion of tooth 32 with a possible supernumerary tooth. Cone-beam computed tomography was used to confirm the radiographic findings and revealed incomplete apex formation of the supernumerary tooth. The fused tooth was subjected to root canal treatment. Calcium hydroxide was used as intracanal medication, changed for every 30 days, for 4 months. Subsequently, the mesial canal received an apical plug of mineral trioxide aggregate mixed with distilled water. At 2 years of follow-up, the tooth showed signs of tissue repair.

Keywords: Cone-beam computed tomography; dental pulp; endodontics; mineral trioxide aggregate

INTRODUCTION

Dental anomalies are caused by genetic disorders or environmental factors that interfere with the morphological differentiation stage of tooth development and may originate teeth with size, shape, and structural abnormalities. Tooth fusion is characterized by the union of two dental germs during the developmental stage; it results from an aberration of both the ectoderm and the mesoderm. The crowns are fused by the enamel and/or by the dentin, and may show two roots or two root canals in a single root. The incidence of tooth fusion is greater in incisors and canines, with an apparently similar distribution in both maxillary and mandibular teeth; cases involving molar teeth are rare. Fusion usually occurs between teeth of the normal series or between a normal and a supernumerary teeth, with the latter presenting various morphologies.

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in turn, without extra scanning time, offers multiplanar or three-dimensional reconstructions of conventional transaxial computed tomographic images.\cite{4,10} This technology enables the reconstruction of overlapping structures at different slice thicknesses and allows to accurately distinguish small anatomical features.\cite{8,9,11}

In the present study, we describe a case of successful root canal treatment of an anomalous, fused inferior mandibular incisor, using CBCT as a diagnostic aid.

**CASE REPORT**

A 24-year-old male patient in good general health sought treatment with a chief complaint of “a small lump in the mandibular anterior region of the mouth.” Clinically, tooth 32 showed increased crown width in relation to the other tooth of the same arch. Radiographic examination revealed the presence of a dental anomaly characterized by fusion of tooth 32 with a possible supernumerary tooth [Figure 1a]. Intraoral examination revealed the presence of a fistula in the buccal region corresponding to the root apices of teeth 32 and 33 [Figure 1b]. CBCT scans [Figure 1c] confirmed the anomaly and provided details about the root canal system of the fused teeth, especially incomplete apex formation in the supernumerary tooth [Figure 1d-1h].

Pulp tests were performed in all mandibular anterior teeth using Endo-Frost (Roeko-Wilcos do Brasil, Rio de Janeiro, Brazil) and suggested the presence of nonvital pulp tissue in tooth 32. The need for root canal treatment was determined for the fused tooth only.

Once the treatment plan was established, the patient signed an informed consent form agreeing to the study procedures. The patient was anesthetized, and the operating field was isolated using rubber dam and clip 210. Coronal access was performed using a spherical diamond bur #1014 (Dentsply Maillefer, Ballaigues, Switzerland) and an Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland). Entrance orifices were located, and the canals were explored using #10, 15, and 20 K-files (Dentsply Maillefer, Ballaigues, Switzerland). The cervical and middle thirds of the root canal were prepared using an LA Axxess #20.06 bur (SybronEndo, Portland, USA). Working length of the two canals was established 1 mm short of the radiographic apex, and the surgical diameter was determined using a #55 K-file (Dentsply Maillefer, Ballaigues, Switzerland).

At each instrument change, canals were thoroughly irrigated with 2 mL of 1% sodium hypochlorite. Final irrigation was performed with 2 mL of 17% EDTA for 3 min, followed by 2 mL of 1% sodium hypochlorite. The root canal was then

Figure 1: (a) Preoperative intraoral periapical radiograph of fused teeth (tooth 32 and supernumerary tooth) showing a large apical radiolucent area. (b) Gutta-percha cone fistulous path showing the relationship between the radiolucent area and the fused tooth. (c) Cone-beam computed tomography scan showing the presence of a radiolucent area in the anterior region, between teeth 32 and 33. (d) Cone-beam computed tomography scan in longitudinal direction showing an open apex in the fused tooth and (e) a radiolucent area in the apical region of tooth 32. Cone-beam computed tomography scan of tooth 32 in axial direction: (f) cervical, (g) middle, and (h) apical thirds
dried with absorbent paper points (Dentsply Maillefer, Ballaigues, Switzerland), and an intracanal medication containing calcium hydroxide and saline solution was placed in the canal and changed for every 30 days, for 4 months. During this phase, the tooth was temporarily restored with resin (Dentsply Maillefer, Ballaigues, Switzerland).

Subsequently, the mesial canal received an apical plug of white mineral trioxide aggregate (MTA) BIO® (Angelus Indústria de Produtos Odontológicos, Londrina, Brazil), which was manipulated with distilled water. One week later, root canal filing was performed. Root canals were filled using #60 McSpadden compactors (Dentsply Maillefer, Ballaigues, Switzerland) with Sealapex® (SybronEndo, Portland, USA) and gutta-percha cones (Dentsply Maillefer, Ballaigues, Switzerland) [Figure 2a].

The patient returned after 2 years for follow-up and did not show any pain, fistula, edema, or periodontal pockets. In addition, tissue color was normal, and tissue repair was observed both on CBCT [Figure 2b-d] and on the intraoral periapical radiograph [Figure 2e].

**DISCUSSION**

Knowledge of the morphological and anatomical characteristics of the root canal system is the key to ensure a successful treatment.[3,5,7] However, major anatomical variations are frequently observed in clinical practice. Tooth fusion is characterized by large clinical crowns and the presence of one pulp chamber and two root canals.[1,2] More common in the anterior region, the presence of anomalous teeth can lead to esthetic discomfort due to irregular crown morphology.[1,4,12] In addition, fused teeth are more vulnerable to dental caries and periodontal disease.

Root canal treatment of fused teeth is often challenging due to canal shape abnormalities.[8] Fused teeth show great variations in terms of pulp chamber size, pulpal obliteration, and root canal configuration.[1,6] In this case, fusion occurred between a mandibular incisor and a supernumerary tooth – an uncommon finding. Examination allowed identifying increased crowns in comparison to other teeth in the arcade and separate pulp chambers, which are difficult to diagnose.

Treatment prognosis depends on adequate cleaning of the root canal system. Complications are usually related to the abnormal tooth morphology, which makes instrumentation and filling more difficult.[11] In this sense, thorough clinical and imaging examinations are determinant of the success of root canal treatment.[7] When pathological signs or clinical symptoms associated with the fused tooth are absent, the anomaly can only be diagnosed by imaging.[4,11] Conventional intraoral periapical radiographs are useful to evaluate the dentition, assess possible maxillary bone alterations, and observe the patient’s internal and external dental anatomy.[12] In complicated cases, however, radiographs are limited, as two-dimensional images limit the extent and accuracy of the investigation. As shown in the present study, CBCT could be used in these more complex cases, providing dentists with highly accurate three-dimensional anatomical information of the maxilla, mandible, teeth, and supporting structures.[4,8,11]

The therapies indicated for fused teeth can range from esthetic management of the patient’s discomfort until complete tooth replacement.[2] In this case, we chose to maintain the original tooth and perform root canal treatment. In cases showing cavities with external communication, control of contamination processes is paramount.[13] Following biomechanical preparation and thorough irrigation with 1% sodium hypochlorite, a mixture of calcium hydroxide and saline solution (calcium hydroxide paste) is used as medication in-between treatment sessions to complete disinfection and stimulate apical closure and/or the deposition of mineralized tissue.[14] In 78% of the cases, apical closure is obtained about 5 or 6 months after the use of calcium hydroxide paste as intracanal medication.[15] In our case, because of the open apex in the supernumerary tooth, even after the use of intracanal dressing, an MTA plug was placed in the apical portion of the root before root canal filling, working as a
CONCLUSION

The present case report confirms that anomalous teeth requiring root canal treatment pose many challenges to dental practitioners. However, the study also reveals that new tools and materials, in general, and CBCT, in particular, are useful and can greatly improve treatment success.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES