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Nonsurgical endodontic treatment of a C-shaped, calcified maxillary first molar with five canals and a single fused root

KEYWORDS
C-shaped root canal configuration;
Maxillary molars;
Calcification;
Cone-beam computed tomography

Maxillary first molars typically exhibit three roots and four canals.[1,2] While the prevalence of C-shaped root canal configuration is notably high in mandibular second molars (44.0%) among the Chinese population, it is exceedingly rare in maxillary first molars (0.54%).[1,2] This paper presented a challenging case involving a C-shaped maxillary first molar with a severely calcified pulp chamber, a single fused root, and five root canals.

A 23-year-old Chinese female patient presented with a chief complaint of experiencing chewing pain of tooth #26 for one month. The tooth exhibited tenderness to percussion and showed negative responses to pulp cold and electric tests. Periodontal probing revealed measurements within normal limits. Periapical radiograph showed that tooth #26 had a severely calcified pulp chamber, a composite resin restoration and a singular conical root (Fig. 1A). Tooth #26 was diagnosed with necrotic pulp and symptomatic apical periodontitis. Nonsurgical root canal treatment was proposed, and the patient provided written informed consent.

Tooth #26 was isolated with a rubber dam, and access cavity was prepared. An ultrasonic tip was used to remove pulp stone and clean pulp chamber. The mesiobuccal (MB), distobuccal (DB), second distobuccal (DB2) and palatal (P) canals were located under a dental operating microscope. Cone-beam computed tomography (CBCT) scan was performed due to the unusual root morphology and the unsuccessful attempt to locate the second mesiobuccal (MB2) canal. Axial section of CBCT image revealed that teeth #26 and #16 had a fused root with C-shaped root canal configuration (Fig. 1B). 3D reconstruction of CBCT images showed the apical part of the single fused root and large apical foramina of tooth #26 (Fig. 1C). Axial section of CBCT image revealed the absence of the MB2 canal in the coronal third of the root (Fig. 1D) and its presence in the middle third (Fig. 1E). Sagittal section demonstrated that the upper half of MB2 canal was calcified, while its lower part remained visible (Fig. 1F). Measurement in the CBCT image showed that calcified segment length of MB2 canal was 4.40 mm (Fig. 1G). The MB2 canal was located under precise guidance from the 3D navigation of CBCT images, ensuring the correct insertion depth and angle of an ultrasonic tip. All canals were negotiated, instrumented and disinfected (Fig. 1H and I). Intracanal medicament with calcium hydroxide paste was applied for two weeks. At the second appointment, tooth #26 was asymptomatic. All canals were obturated using the warm vertical compaction technique, after which a full crown restoration was scheduled (Fig. 1J-L). At the 24-month follow-up examinations, tooth #26 maintained asymptomatic and exhibited normal lamina dura in the periapical area (Fig. 1M).

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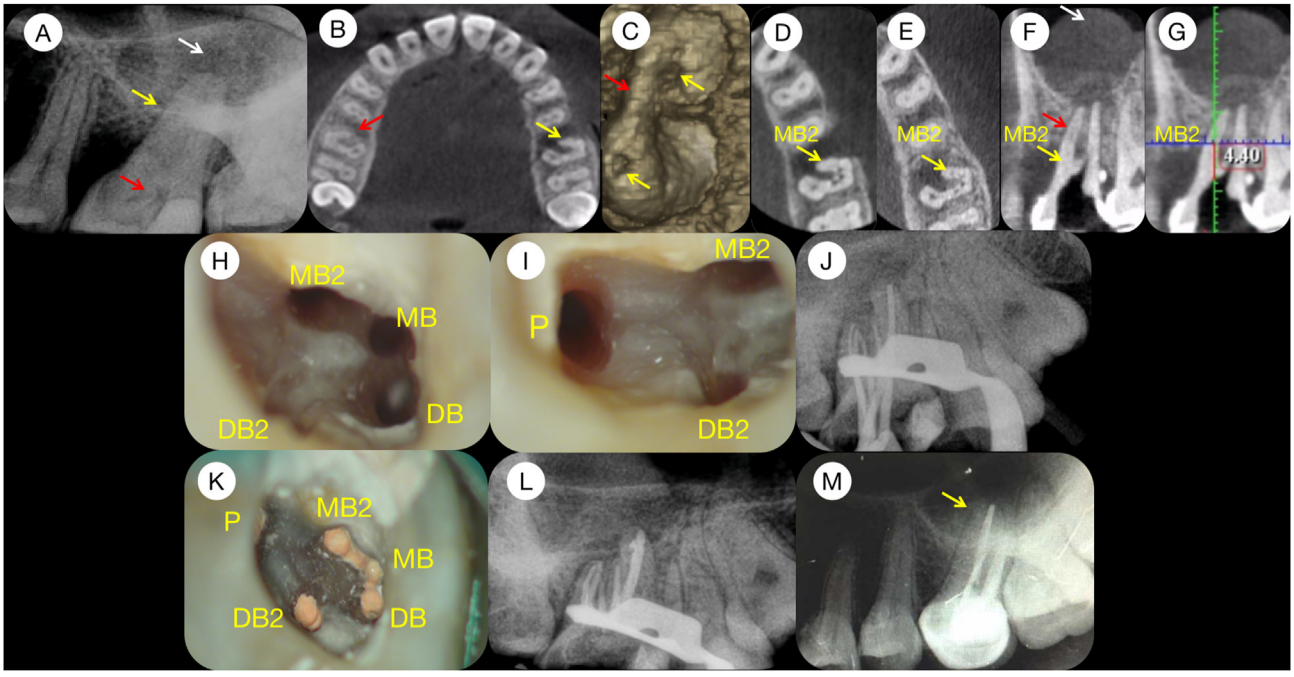

Figure 1 Microscopic photographs and radiological images. (A) Pre-operative periapical radiograph showed that tooth #26 had a composite resin restoration in close proximity to the severely calcified pulp chamber (red arrow), a single conical root (yellow arrow) and a large radiolucent region in the periapical area (white arrow); (B) Axial section of CBCT image revealed that teeth #26 (yellow arrow) and #16 (red arrow) had a similar fused root with C-shaped root canal configuration; (C) 3D reconstruction of CBCT images showed the apical part of the single fused root (red arrow) and large apical foramina (yellow arrows) of tooth #26; (D) Axial section of CBCT image in the coronal third of the root revealed the absence of MB2 canal (yellow arrow); (E) Axial section of CBCT image in the middle third of the root revealed the presence of MB2 canal (yellow arrow); (F) Sagittal section of CBCT image demonstrated that the upper half of MB2 canal was calcified (yellow arrow) and its lower part was visible (red arrow). The significant thickening of the maxillary sinus mucosa was also noted (white arrow); (G) Measurement in the CBCT image showed that the length of calcified segment of MB2 canal was 4.40 mm; (H and I) Microscopic photographs showed that MB2 was located, negotiated and instrumented; (J) Cone-fit radiograph revealed five canals of tooth #26; (K) Microscopic photograph showed that MB, MB2, DB, DB2 and P canals were obturated by the warm vertical compaction technique with gutta-percha and sealer; (L) Post-obturation radiograph; (M) Periapical radiograph at the 24-month follow-up examinations displayed normal lamina dura (yellow arrow) in the periapical area of tooth #26. Abbreviations: CBCT: Cone-beam computed tomography; DB: distobuccal; DB2: second distobuccal; MB: mesiobuccal; MB2: second mesiobuccal; P: palatal.

Managing a maxillary first molar having a fused root with C-shaped root canal configuration can be a challenging task, primarily due to its intricate and unpredictable morphology.[1,2] The presence of a severely calcified pulp chamber further complicates the successful identification and treatment of all canals.[3,4] In such situations, limited field of view (FOV) CBCT images can offer invaluable 3D diagnostic insights and aid in navigation.[3] The "as low as reasonably achievable (ALARA)" principle should always be kept in mind for ensuring patient safety. If nonsurgical treatment proves unsuccessful, endodontic microsurgery may become necessary as an alternative approach.[5]

Declaration of competing interest

The authors have no conflicts of interest relevant to this article to declare.

Acknowledgments

None.

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