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CASE REPORT

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Maxillary first molar with two distobuccal root canals and cervical deformity: A case report

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Key Clinical Message

The second distobuccal canal in the maxillary first molar is often missed because of the low prevalence rate (0%–4%). The article reports this kind of variation in one case. Promising outcomes have continued up to the present (2-year follow-up).

KEYWORDS

cervical deformity, maxillary first molar, root canal retreatment, second distobuccal canal

1 | INTRODUCTION

Maxillary first molars are generally three-rooted with three or four root canals.[1] Extra canals are often found in the mesiobuccal (MB) root, with an incidence of more than 50%. Most distobuccal (DB) and palatal roots only have a single canal. Even in studies carried out in different populations using different methods, the prevalence of a second distobuccal canal is only 0%–4%,[2–4] resulting in a high rate of missed diagnosis. In our current case, chronic apical periodontitis was caused by the missed extra distobuccal canal and the affected tooth also had a cervical deformity. In this case report, we describe the diagnosis and treatment of a single case of a maxillary first molar with two distobuccal root canals and cervical deformity. The combined application of cone beam computed tomography (CBCT), microscopic root canal therapy, and computer-aided design/computer-aided manufacturing (CAD/CAM) of the crown restoration improved the outcomes.

2 | CASE REPORT

2.1 | Medical history and clinical findings

A 32-year-old woman presented at our dental clinic complaining of pain on biting in the left maxillary first molar (FDI tooth 26). The tooth had been found to be carious 2 months previously, and had been treated with root canal therapy and a direct composite resin restoration in another hospital. Subsequently, the patient presented with food impaction and gingival swelling. She did not experience any heat/cold pain or spontaneous pain. No significant medical history or systemic diseases were found.

Clinical examination revealed that the tooth-colored filling material of the tooth 26 was not correctly sealed, and the distal proximal contact was excessively tight. Abnormal morphology was seen in the distobuccal cervical portion of tooth 26 after the filling material was removed. The probing depth was 4 mm at this site and the

bleeding index was 4. The tooth responded with pain to a percussion test. The distal gingival papillae were red and swollen. There were no positive signs in the apical mucosa, and no sinus tract stoma was observed (Figure 1).

2.2 | Diagnosis

Periapical radiography revealed that the radiopaque filling material extended into the pulp cavity. Of the three roots that had been filled, the palatal root was overfilled. The periapical area could not be satisfactorily visualized. The distal alveolar crest was slightly resorbed (Figure 2A). Cone beam computed tomography (CBCT) revealed a radiolucent lesion adjacent to an extra root canal, which was missed and unfilled, in the distobuccal root (Figure 3). The missed extra root canal was located on the buccal wall of the filled DB canal. According to the naming convention, the missed extra canal was DB_1. The canal which was treated in the initial treatment was DB_2.

Based on the radiographic and CBCT findings, a diagnosis was reached of symptomatic apical periodontitis of tooth 26.

2.3 | Therapeutic strategy

It was decided that the patient required initial periodontal therapy, root canal retreatment of tooth 26, and a full crown restoration after ensuring the success of the root canal retreatment.

Treatment was performed using a dental operating microscope (Zumax, Jiangsu, China). First, the contact area was improved by removing the old filling material and replacing it with a new restoration. Initial periodontal therapy was commenced to treat the local gingivitis. Then, tooth 26 was clamped and a rubber dam was placed. Guided by the CBCT three-dimensional images, the old root canal filling materials in the three canals was removed. The upper section of the DB root

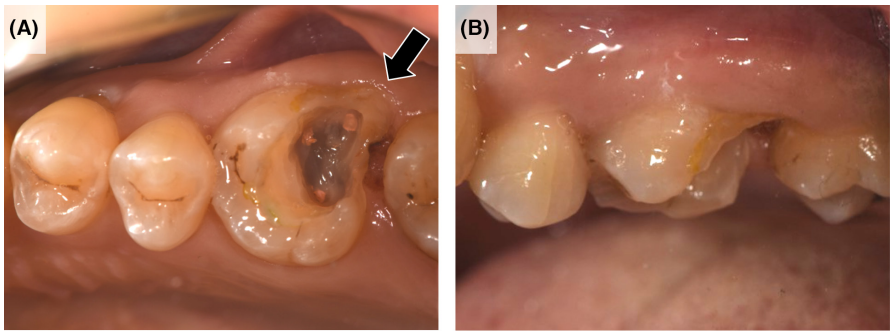

FIGURE 1 Intraoral photographs of tooth 26 before treatment (after removal of the filling material). (A) Occlusal view. Black arrow shows the cervical deformity of the distal buccoaxial angle. (B) Buccal view.

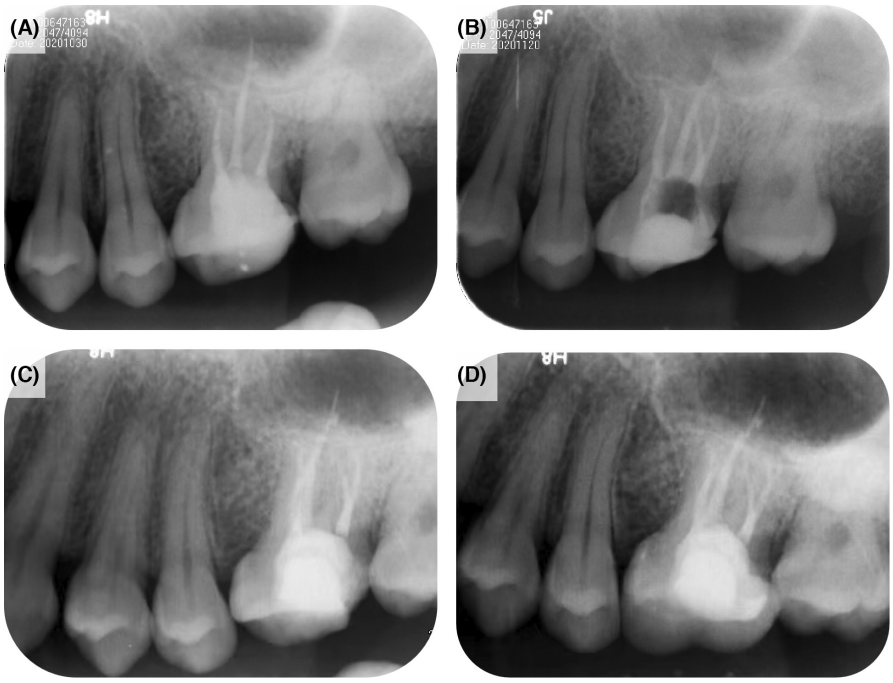

FIGURE 2 Periapical radiographs taken using the distant paralleling technique before and after root canal retreatment of tooth 26. (A) Before retreatment. (B) Immediately after retreatment. (C) 12 months after retreatment. (D) 2 years after retreatment.

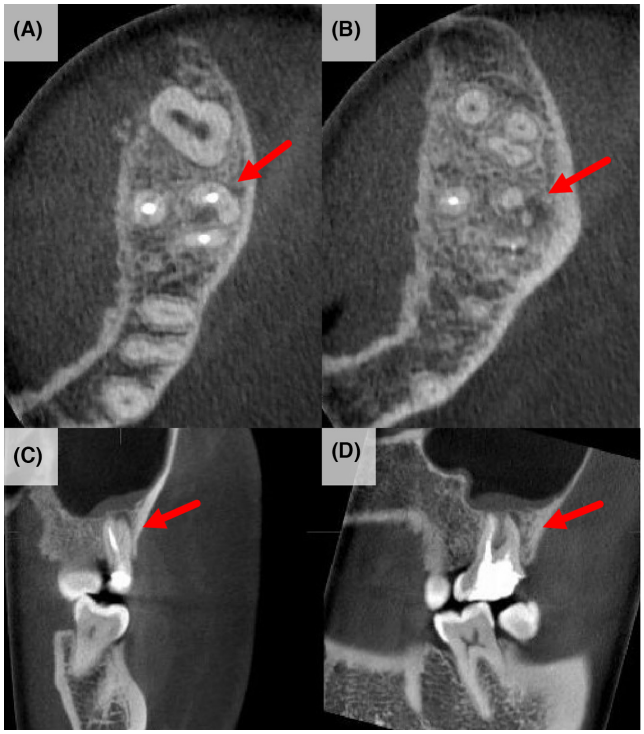

FIGURE 3 Cone beam computed tomography images of tooth 26 before retreatment of the root canal. (A) Cross-sectional view; the red arrow indicates an extra distobuccal canal (DB_1) with no visible root canal filling. (B) Cross-sectional view; the red arrow indicates the radiolucent lesion adjacent to the distobuccal root apex. (C) Coronal view; the red arrow indicates the missed second distobuccal canal. (D) Sagittal view; the distobuccal root was surrounded by a radiolucent periapical area.

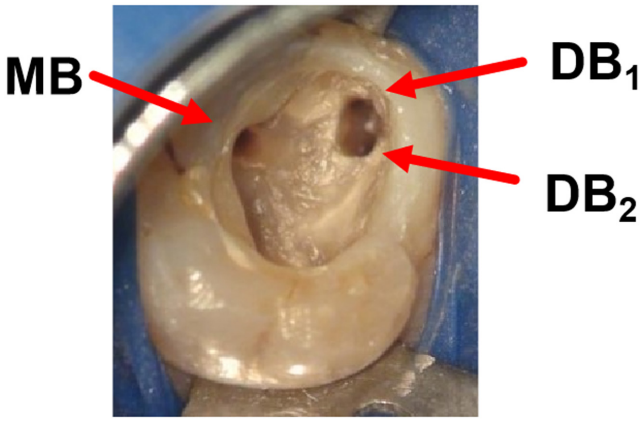

FIGURE 4 Intraoperative microscopy of the pulp chamber of tooth 26. DB_2 was found during the initial treatment. DB_1, located on the buccal side of DB_2, was identified during the retreatment.

was opened with the ET40 ultrasonic tip (Satelec, Viry-Châtillon, France) to expose the orifice of the extra distobuccal canal (DB_1) that was located on the buccal wall of the original canal (DB_2) (Figure 4). A precurved 08# C-file (VDW, Munich, Germany) was used to access the DB1 and reach the working length. The M3 nickel-titanium system (Yirui, Jiangsu, China) was used for the mechanical preparation of the root canals, with a final width and taper of 30# and 0.04, respectively. An ample amount of 2.5% sodium hypochlorite solution combined with ultrasonic irrigation was used during and after the root canal preparation. After intracanal medication with calcium hydroxide paste for 1 week, the canals were dried and obturated using a warm vertical condensation technique with AH-Plus paste (Dentsply Sirona, Charlotte, NC, USA) as a sealer cement. The periapical radiograph confirmed that the root canals were correctly filled (Figure 2B). A resin composite restoration was placed immediately after the root canal treatment.

2.4 | Follow-up and permanent restoration

Because the patient was working in another city, the first follow-up visit took place 12 months after treatment, and confirmed that the apical lesion had healed and the pain on biting had completely disappeared (Figure 2C). An all-ceramic restoration was then fabricated using computer-aided design / computer-aided manufacture (CAD/CAM) (Figure 5).

Two years after the endodontic therapy and 1 year after the crown restoration, the patient was symptom-free. The margins of the all-ceramic crown were sealed, the interproximal contacts were suitably tight, and no periapical lesion was visible on the periapical radiograph (Figure 2D).

3 | DISCUSSION

Missed root canals are one of the main causes of failure in endodontic therapy. Karabucak et al. examined CBCT images of 1137 teeth (premolars and molars) after endodontic therapy and found that the incidence of missed root canals was 23.0%. Of the teeth with missed root canals, 82.8% had periapical lesions, which all occurred around the root apex in the location of the missed canal.[5] Therefore, a solid knowledge of root canal anatomy and the ability to search for extra root canals during treatment are essential for endodontists. According to Vertucci's classification system for root canal morphology,[6] Type 2–1 is the most common in the DB root with multiple canals, accounting for about 96.2%–100%. Sun et al.[7] and Cui et al.[8] have described this type in the Chinese population. In contrast, the prevalence of Type 2–2 (with two separate canals), as reported by Su et al.,[9] in the Chinese population is only 1.9%. The condition described in our

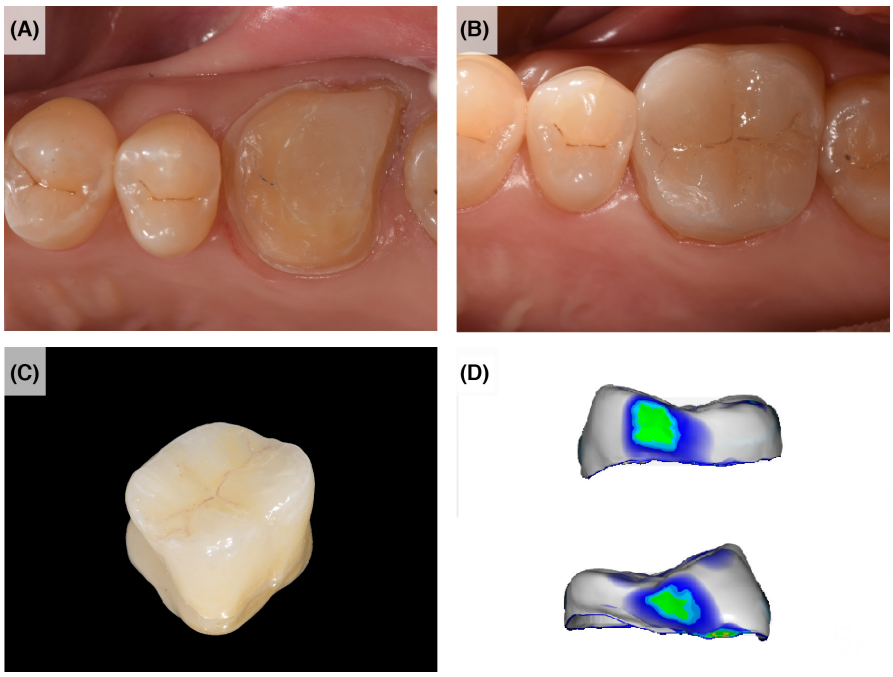

FIGURE 5 Computer-aided design / computer-aided manufacture (CAD/CAM) full crown restoration for tooth 26. (A) Occlusal view of the tooth preparation. (B) Occlusal view after cementation of the crown. (C) The crown. (D) CAD/CAM design drawing: the distal contact area (upper image) and the mesial contact area (lower image). Green areas indicate areas of contact, and blue areas that are 30 μm away from the green areas indicate the absence of contact.

article is a rare case of a Type 2–2 canal. According to Vertucci, the distance between the orifices of two root canals may predict whether the canals will be fused or separate. The two canals tend to remain separate if the distance between these two orifices is greater than 3 mm, and conversely, the two canals are usually fused if the distance is smaller than 3 mm.[6] However, his argument does not fit well with our present case, in which the orifices of the two DB root canals were quite close but the canals were separate below, which explains why the extra DB canal was missed.

CBCT has an accuracy of up to 89% in detecting extra root canals of maxillary molars[10] and played a decisive role in the diagnosis of our present case. Notably, when one of the two canals was treated during the initial therapy, the position of the orifice of the other canal might have changed, resulting in increased difficulty in retreatment. CBCT provides a 3D approach to locate the extra DB orifice and can reveal the course, curvature, and degree of calcification of the root canals more accurately and intuitively from multiple angles, offering sufficient information for the retreatment of missed root canals.

As shown in our present case, root canal microscopy plays an important role in the treatment of complex root canal systems. With functions including magnification and illumination, microscopy was able to locate the tiny extra DB orifice, even in the presence of old root filling materials and an enlarged original DB canal. If our patient had undergone microscopy during the initial treatment, the orifice of DB_1 might have been detected earlier, which would greatly reduce the treatment costs.

In addition to this rare abnormality of the root canal system, the patient also had a morphological variation in the cervical region of the tooth, which made direct restoration particularly challenging. Inappropriate contact areas result in gingivitis, which can also cause biting pain, and may lead to a misdiagnosis of periapical periodontitis. If the interproximal contacts are not corrected, the symptoms may continue to interfere with the efficacy of the root canal retreatment over time. Therefore, precise design of a crown restoration is particularly important after successful endodontic therapy. In the present case, chairside CAD/CAM was used in the fabrication of an all-ceramic full crown restoration, allowing adjustment of the contact areas with an accuracy of 30 μm. This technique minimizes the possible damage to contact areas caused by manual adjustment before cementation of the crown and results in more suitable interproximal contacts.

4 | CONCLUSION

This case reflects the complexity and diversity of the root canal system of maxillary first molars, highlights the important role of auxiliary means, such as microscopy and CBCT in endodontic therapy, and demonstrates the advantages of crown–root integrated treatment.

AUTHOR CONTRIBUTIONS

Xue Cai: Conceptualization; data curation; methodology; project administration; visualization; writing – original draft; writing – review and editing. **Rentao Tang:** Data curation; methodology; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

All data supporting the findings are available within the manuscript.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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