Rare Root Canal Configuration of Bilateral Maxillary Second Molar Using Cone-beam Computed Tomographic Scanning

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Abstract

The aim of this article was to present a right maxillary second molar with an unusual root canal morphology of 4 roots and 5 canals as confirmed by cone-beam computed tomographic (CBCT) imaging. The tooth had a C-shaped mesiobuccal root (CBCT imaging revealed that the root was closer to the palate than the buccal side) with 2 canals, 2 fused distobuccal roots with 2 separate canals, and 1 normal bulky palatal root with 1 canal. After thoroughly examining the rare anatomy, root canal treatment was applied on the tooth. This article shows the complexity of maxillary second molar variation and shows the significance of CBCT imaging in the confirmation of the 3-dimensional anatomy of teeth and endodontic treatment. *(J Endod 2016;42:673–677)*

Key Words

Cone-beam computed tomography, maxillary second molar, root anatomy

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Root canal treatment is widely used for pulpitis and periapical disease, and root canal treatment of the maxillary second molar (MSM) can be very difficult. Beside the innermost position of the molar, the limitations of instruments and the high variation of the MSM canal systems are the major reasons for the difficulties of root canal treatment. The most common morphologies of MSM roots are the mesiobuccal (MB) root, the distobuccal (DB) root, and the palatal root, with incidences varying between 73.6% and 94.6% (1–4). A separate canal in each root usually exists. The most common variation is the second MB (MB2) root canal; its incidence is different in studies, varying between 13.87% and 78.9% (1, 3, 5, 6). An MB2 canal in the MSM is not as common as in the maxillary first molar (MFM). Variation in the DB root is rare; the reported occurrence is only 0.3% (4).

Some unusual anatomy of the MSM has been reported in the literature. Several authors reported MSMs with 2 roots (ie, mesial and distal roots, which are similar to mandibular molars) and 2 root canals in each root (7, 8). Zmener (9) and Ozcan et al (10) reported MSMs with 3 canals in the MB root. Kottoor et al (11) showed a case of 5 roots with 5 canals. Double palatal roots were also reported by several authors (12, 13). Successful root canal treatment requires sufficient knowledge of the morphology of the root canal systems. In the early 1960s through 1980s, endodontists found variations of root canal systems by examining teeth without relying on technology and by merely making use of their experience. At present, with the help of microscopes and cone-beam computed tomographic (CBCT) imaging, these unusual variations can be confirmed, and successful root canal treatment can be performed. Radiography is necessary in root canal treatment. However, in certain instances, radiography may not be enough, particularly when variations are present. CBCT scanning is a new technology that is being used in dentistry. Compared with radiography, CBCT imaging can show 3-dimensional (3D) scanning images of all teeth, which can aid dentists in fully understanding the structure of teeth and root canals.

The right MSM used in this study had 4 roots: 1 C-shaped MB root, 2 fused DB roots, and 1 bulky palatal root. The MB root is a C-shaped root with 2 canals, and it was closer to the palatal side. In addition, the DB roots are 2 fused roots; the upper roots are fused together, and the lower segment clearly shows the 2 separate roots. Endodontic treatment of this tooth was performed with the aid of CBCT imaging.

Case Report

A 26-year-old Chinese woman presented to Wuhan University Stomatological Hospital, Wuhan, China. Her chief complaint was pain on her right maxillary molar that had persisted for 3 days and radicular pain on the right side of her head. The pain was extremely severe at night, preventing her from sleeping. According to the patient, she did not have a systemic disease. Clinical examination showed caries on the buccal side of her right MSM (tooth #2). The caries developed to the subgingiva, and the root was exposed. The carious tooth was mobile of the first degree and showed severe sensitivity to probe, percussion, and the thermal test. Vitality testing of the involved tooth with heated gutta-percha and dry ice caused an intense lingering pain, whereas electronic pulp stimulation (SybronEndo, Orange, CA) caused a premature response. Radiographic examination showed that this tooth had low density on the middle distal area of the crown and no obvious periapical lesion (Fig. 1*A*); the examination also showed no obvious root canal abnormity of tooth #2. Based on the findings, the

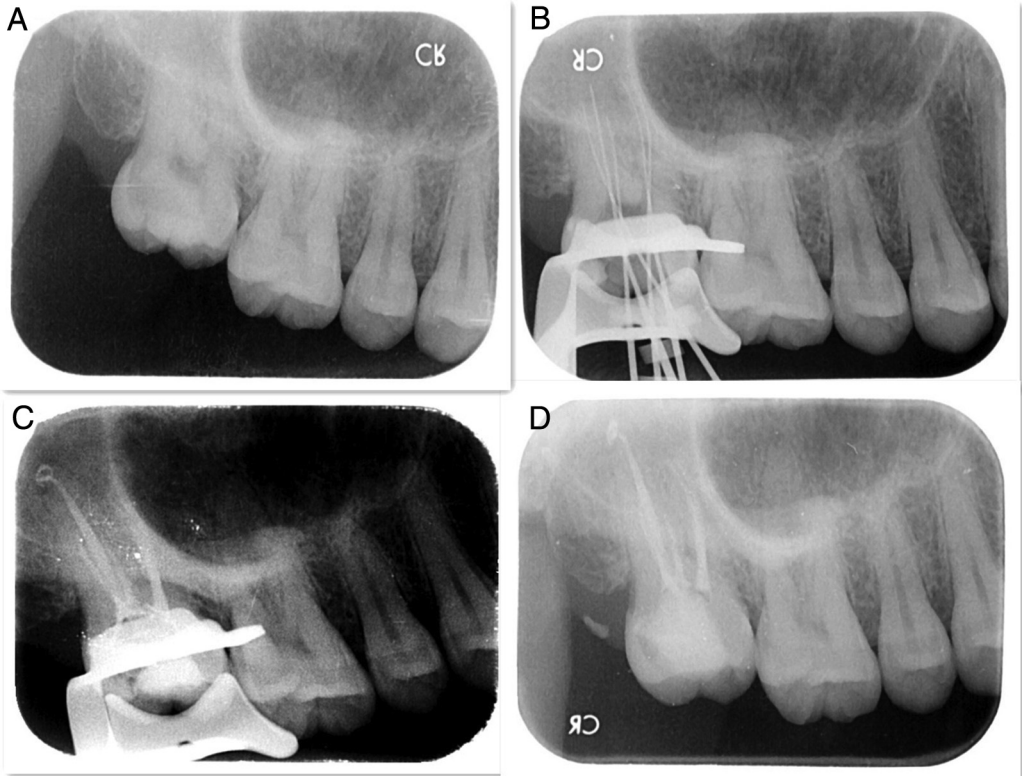

Figure 1. (*A*) Preoperative radiograph of tooth #2. (*B*) Working length determination. Radiograph with K-files showing 5 separate root canals. (*C*) After root canal treatment. (*D*) One-month follow-up. No obvious abnormities were observed. Restoration was suggested to the patient.

diagnosis of her right MSM was acute pulpitis. Root canal treatment was suggested, and the patient consented.

Local anesthesia with 4% articaine containing 1:100,000 epinephrine (Primacaine; Acteon Group, Merignac Cedex, France) was administered to the tooth. After a rubber dam was placed, an access opening was created. The palatal orifice was easy to find. With the help of the DG16 endodontic explorer (Hu Friedy, Chicago, IL), 2 DB orifices were also found. During examination using a surgical operating microscope (Carl Zeiss, Oberkochen, Germany), the fourth canal was located on the mesial side (ie, between the buccal and palatal pulp floor). This unusual morphology aroused our suspicion that other canals existed.

To ascertain the variations in the root and canal, a CBCT scan was performed. The access cavity was sealed with glass ionomer cement (Medical Equipment Factory of Shanghai Medical Instruments, Shanghai, China). Informed consent was obtained from the patient, and a multislice CBCT (NewTom VG; QR Srl, Verona, Italy) was performed with a tube voltage of 110 kV and a tube current of 4.05 mA. All protective measures were undertaken to protect the patient from scattered radiation. CBCT scanning images (Fig. 2) and 3D reconstruction images (Fig. 3) were obtained. They showed the presence of 4 roots and 5 canals: 1 MB root, 2 DB roots, and 1 palatal root. The MB root was a C-shaped root with 2 canals. The DB roots had 2 canals in each of the roots, and the palatal root had 1 canal (Figs. 2*A–D* and 3*A–D*, *F*, *G*, *I*, and *J*).

With the assistance of CBCT images, the ET 20 Ultrasonic core (Acteon Group) was used under a microscope to discover another orifice of the MB root. Five canals were found (Fig. 2*E–G*). Coronal enlargement was performed using nickel-titanium ProTaper S1 and SX files (Dentsply Maillefer, Ballaigues, Switzerland) to obtain a straight-line access. The working length was measured with an electronic apex locator (SybronEndo) and confirmed using a radiograph with K-files (Dentsply Maillefer) (Fig. 1*B*). Then, the root canals were cleaned and shaped with PathFile (Dentsply Maillefer) and ProTaper nickel-titanium rotary instruments (Dentsply Maillefer) using a crown-down technique. During preparation, EDTA gel (Longly, Wuhan, China) was used as the lubricant. Irrigation was performed with 2.5% sodium hypochlorite. Ultrasonic irrigation with normal saline was used for the final irrigation. The tooth was intracanal medicated with calcium hydroxide and sealed with Caviton White (GC Corp, Tokyo, Japan). After 1 week, the patient came back and reported that she did not feel pain on the tooth when the tooth was palpated. Under a rubber dam, final rinsing of the canals was performed by using normal saline coupled with ultrasonic agitation. The canals were dried with absorbent paper points (Gapadent, Tianjin, China). The tooth was obturated using the warm gutta-percha condensation technique with the Elements Obturation Unit (SybroEndo, Glendora, CA). AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) was used as the sealer. The obturating results are shown in Figures 1*C* and *D* and 2*H–K*.

Discussion

With the development of endodontics, radiography has been an essential part in handling endodontic problems. Conventional radiographs such as X-rays and panoramic radiography helped dentists better understand the problem of teeth, periodontal tissue, the jaw, and so on. These radiographs have been applied for many years because of their low price, easy operation, relatively low radiation dose, and immediate results. However, these radiographs can provide only 2-