Rare Root Canal Configuration of Mandibular Second Premolar Using Cone-beam Computed Tomographic Scanning

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Abstract

The aim of this case report was to demonstrate how the use of cone-beam computed tomographic (CBCT) imagery is beneficial when treating a tooth with an unusual anatomic variation. A 43-year-old female patient presented to our private practice after a referral from her general dentist. Endodontic therapy was previously initiated and unable to be completed because of suspicious anatomic anatomy. CBCT imagery confirmed the presence of a C-shaped root configuration and 3 canals within the tooth. Root canal treatment was completed successfully without complications. The use of CBCT imaging was valuable in determining the root morphology and rare canal anatomy to enhance treatment and success. *(J Endod 2017;■:1–4)*

Key Words

C-shaped root configuration, cone-beam computed tomographic imaging, successful root canal treatment, unusual mandibular second premolar anatomy

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Significance

This case report details the unusual anatomy of a mandibular premolar. CBCT imaging can be used to visualize the reasons why a previous endodontic treatment failed. CBCT imaging can influence the diagnosis and successful endodontic retreatment of teeth.

Root canal treatment is widely used for cases of irreversible pulpitis and pulpal necrosis with periapical disease, and the root canal treatment of teeth with an unusual anatomic variation can be difficult. The endodontic triad for success entails shaping the canal system, cleaning the canals in all dimensions, and obtaining a homogenous obturation and fill of the canals. Clearly, the success of endodontic treatment requires the identification of all canals within the tooth harboring inflamed and necrotic tissues as well as bacteria (1, 2). Therefore, an understanding of root canal morphology as well as any variation in its anatomy is imperative to achieve successful endodontic treatment (3).

The mandibular premolar is 1 of the most difficult teeth to treat because of its high variation in its morphology and anatomy (4). Although this statement may be true for the mandibular first premolar, it is commonly accepted that the mandibular second premolar is a single-rooted tooth with a single root canal system. A literature review encompassing over 7700 mandibular premolar teeth concluded that almost all second premolar teeth were single rooted and that multiple roots were extremely rare (3). A single canal was present in 91% of these teeth (3).

Cone-beam computed tomographic (CBCT) imaging has surpassed conventional radiography in terms of its ability to visualize root canal morphology and anatomy. Information gathered from a CBCT image can show root anatomic anomalies within root canals that cannot be clearly seen on conventional radiographs. CBCT imaging is beneficial for detecting and interpreting aberrant canal morphology (5). A study concluded that CBCT images can aid dentists in identifying a greater number of root canal systems when compared with conventional radiographic images (6). Some other studies have reported that CBCT can enhance root canal identification (7–10), making it easier for the clinician to complete the aforementioned endodontic triad.

The following is a case report of a patient who presented to private practice with root canal treatment previously initiated on tooth #29. CBCT imaging detected the presence of 3 independent canal systems within the tooth, and root canal therapy was completed successfully.

The purpose of this case report was to describe how a previously undetected, complex anatomy in a mandibular premolar was discovered and managed using CBCT imaging. The mandibular second premolar in this study had a common canal orifice that trifurcated into 3 canals. An axial view also yielded root morphology resembling a C-shaped canal/root configuration. The endodontic treatment of this tooth was performed with the aid of CBCT imaging.

Case Report

A 43-year-old woman with a noncontributory medical history presented to our endodontic private practice in Westminster, CO. Her past dental history was significant because of the recent onset of pain and discomfort localized to tooth #29. Root canal therapy had been initiated by her referring dentist, and it was suspected that more than

1 canal was present in the tooth. She was previously prescribed amoxicillin and hydrocodone for her prior symptoms. At the time of her visit, she reported that the symptoms had improved after the initial endodontic access preparation; however, she also described continued spontaneous pain within the tooth. An extraoral examination detected no abnormalities. The intraoral examination of the soft tissue surrounding the tooth was within normal limits, and there was no visible swelling or sinus tract. The existing crown of tooth #30 was previously displaced before the woman presented to our office. The prior access of tooth #29 was restored with an interim restoration. The probing and periodontal findings were within normal range. Upon tooth sensitivity testing and percussion, the patient gave a heightened response to tooth #29 when in comparison with the surrounding dentition. All other teeth within the lower right quadrant responded normally to pulp vitality testing (with the exception of tooth #31, which was previously treated). Our radiographic interpretation of the digital periapical film (Fig. 1) revealed a prior access opening slightly off-center toward the mesial. The canal system appeared to bifurcate into 2 independent roots. No visible periapical pathosis was observed on radiographic film; the periodontal ligament and lamina dura appeared to be intact without interruption. Further radiographic analysis in the form of CBCT imaging (Carestream 8100 3D; Carestream Dental, Atlanta, GA) revealed a common canal orifice that trifurcates into 3 canals (Fig. 2). The axial view yielded root morphology resembling a C-shaped canal/root configuration (Fig. 3). The coronal section of the CBCT image also revealed an area of apical periodontitis that the conventional digital radiograph did not produce (Fig. 4). After our clinical and radiographic interpretation, we diagnosed previously initiated endodontic therapy with symptomatic apical periodontitis. Written endodontic informed consent was obtained from the patient after a review of all the risks, benefits, and alternatives to treatment. We obtained anesthesia with 3.4 mL 2% lidocaine with 1:100,000 epinephrine via a right inferior alveolar nerve block. Rubber dam isolation was provided (Henry Schein Dental, Melville, NY), and the prior interim restoration was removed. The prior access opening was refined using a 21-mm-length Endo-Z Carbide bur (Henry Schein Dental). Upon access refinement, a ProUltra Endo ultrasonic tip size #3 (Dentsply Tulsa Dental Specialties, Tulsa, OK) was used to locate all 3 canals using a dental microscope (Carl Zeiss Meditec Inc, Dublin, CA). The canal system was irrigated with 6% sodium hypochlorite and 17% EDTA solution. The canals were subsequently dried with paper points (DiaDent Group International, Burnaby, BC, Canada). We initialized the shaping of the canal system by using a ProTaper SX file (Dentsply Tulsa Dental Specialties, Tulsa, OK). The working length measurements were obtained using a Root

Figure 2. CBCT imagery of tooth #29 revealing common canal orifice which trifurcates into independent canals.

ZX II apex locator (J Morita USA, Irvine, CA). After working length measurements were recorded, cleaning and shaping were completed using WaveOne Gold instrumentation (Dentsply Tulsa Dental Specialties) using copious irrigation of 6% sodium hypochlorite. The final irrigation consisted of 17% EDTA with a final rinse of 6% sodium hypochlorite (11). A master cone of gutta-percha (Dentsply Tulsa Dental Specialties) was fitted to length as verified with an electronic apex locator. The warm vertical condensation of gutta-percha with Sealapex sealer (Kerr Dental, Orange, CA) was accomplished with the EndoPro 270 handpiece (Brasseler USA, Savannah, GA). Backfill obturation of the 3 canals was then completed using the Calamus 3D obturation system (Tulsa Dental Specialties, Tulsa, OK). The access cavity was sealed using a small cotton pellet and Cavit G interim restorative material (Patterson Dental, St Paul, MN). A final digital radiograph was taken (Fig. 5),

Figure 1. Preoperative digital radiograph prior to treatment.

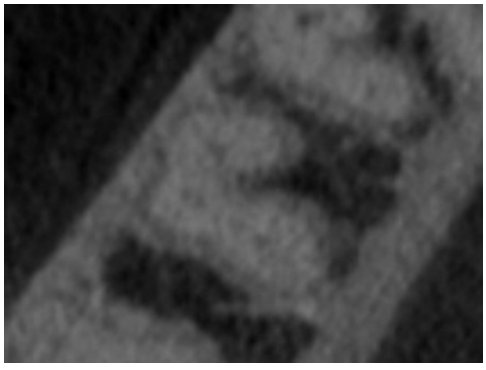

Figure 3. CBCT axial imagery reveals a C-shaped root/canal configuration pattern.