Periapical Healing of a Mandibular Molar with Middle Mesial Canal: A Case Report

Stacey M Woo
Woo Dental Corporation, Anaheim, California, USA

Introduction: Complex root canal anatomies challenge the limits of our skills, techniques, and abilities to clean the root canal system and achieve a successful endodontic outcome.

Keywords: Uninstrumented canals; Middle mesial canal; GentleWave; Apical periodontitis; Periapical healing

Case Presentation

A 25-year-old male with a non-contributory medical history presented to the clinic with a chief complaint of occasional mild sharp pain when biting and chewing. Clinical examination of the left mandibular posterior found tooth #19 with gross caries extending into the pulp. Tooth #19 did not respond to vitality testing with Endo-Ice. Radiographic analysis concluded a pre-operative Periapical Index (PAI) Score 3 (Figure 1A) [20]. Based on clinical and radiographic findings, the diagnosis was Pulpal Necrosis and Asymptomatic Apical Periodontitis (AAP). Root canal treatment was recommended in an attempt to extend the life of the tooth. The prognosis was fair. The patient consented to treatment. Local anesthesia was administered using 4% articaine (72 mg) with 1:100,000 epinephrine and 2% lidocaine (72 mg) with 1:100,000 epinephrine via inferior alveolar nerve block and long buccal nerve block. The tooth was isolated with a rubber dam. The carious lesion was excavated and verified with caries indicator dye. Absent tooth structure was built up with micro-hybrid composite. Four orifices were identified in the pulpal floor. Patency was gained with a size #10 K-file, and working lengths (WL) were measured using an electronic apex locator and confirmed after the GentleWave procedure, despite minimal instrumentation.
Results

Pre-operatively, the tooth was diagnosed with Pulpal Necrosis and Asymptomatic Apical Periodontitis (AAP) and had a Periapical Index (PAI) Score of 3 (Figure 1A). Post-operative radiographs (Figure 1B) show complex anatomies in the root canal system that were not previously realized, including a middle mesial canal and isthmi in the mesial and distal canals filled with obturation materials. These complex anatomies were further confirmed on a post-operative CBCT scan as seen in Figures 2A and 2B. Figures 1A-1D show radiographs of tooth #19 at pre-operative, post-operative and 6- and 9-month recall visits, respectively.

At the 6-month recall, the patient was asymptomatic and the tooth had been restored with a full coverage crown. The tooth was functional. Radiographic analysis showed healing of the periapical lesions (Figure 1C). Complete resolution of apical periodontitis was noted at the 9-month recall and no clinical signs or symptoms were present (Figure 1D). The 9-month post-operative PAI score was 1. CBCT analysis further confirmed periapical healing (Figures 2A and 2B). The patient was prescribed no medications and was advised to return to the general dentist for continued comprehensive dental care.

Discussion

One of the many goals of root canal treatment is to remove as much of this debris as possible, as close to the apex as possible. Studies have examined the relationship between the apical size of instrumentation and cleaning in the apical third.

After endodontic instrumentation, anatomical variations typically contain tissue remnants, bacteria, and dentin shavings that inhibit the ability of irrigation fluids to reach areas of the root canal system. Khademi et al. found that the minimum instrumentation size needed for penetration of irrigants to the apical third is #30 [22]. However, endodontic irrigants have limited access to the apical 3 mm with standard root canal treatment [23]. Studies found that a canal instrumented to a size #35 allows greater irrigation in the apical third [24]. Peters, et al. found that the tested endodontic rotary instrumentation techniques leave 35% or more of the canals surface area unchanged [25]. With increasing file size, there is also an increasing reduction in bacteria [26]. Ricucci et al. found that lateral canals that appear filled after standard root canal treatment are usually a mix of sealer, smear layer, and bacteria, not necessarily cleaned and filled [27].

Studies have looked at ultrasonically-activated acoustic streaming as a technique to augment the ability of irrigants to reach beyond the instrumented canal walls [21,28-31]. However, studies show that while acoustic streaming significantly improves the cleanliness of canals and isthmi over traditional side-vented needle irrigation, an ultrasonically-activated instrument can only remove debris up to 3 mm in front of the file tip and debris still persists near the apex, even after instrumenting up to a ProTaper size F4 [29,32,33].

In this case report, minimal instrumentation to a size #20 was utilized, which under standard root canal treatment would be insufficient to permit irrigants to access the entire root canal system, would leave debris within the root canal system, and would block the ability of obturation materials to reach these areas.

Obturation of complex anatomies suggests that despite minimal instrumentation, cleaning occurred in areas of the root canal system not touched by endodontic fluids. In this case, complex anatomies were revealed in post-operative imaging, including a middle mesial canal in the apical third, mesial isthmus, and distal isthmus (Figures 1B, 2A and 2B), suggesting that the GentleWave Procedure enhanced cleaning in the apical third and in areas not previously realized. Together, this likely contributed to the patient’s favorable endodontic outcome.
Figure 2: Cone beam computed tomography (CBCT) (A and B) images of mesial and distal roots highlighting complex anatomy post-operatively, (C and D) at 9-month recall.

Conclusion

In the present case report, the middle mesial canal originates in the apical region and would not be accessible for instrumentation or irrigation with standard endodontic techniques. To instrument and irrigate a middle mesial canal in the apical third would require further separation, strip perforations, and ledges and compromising the integrity of the tooth structure. However, through minimal instrumentation and Multisonic Ultracleaning of the root canal system using the GentleWave Procedure, the middle mesial canal was cleaned and dentin was preserved.

In root canal treatment, cleaning is often a balance between dentin preservation and instrumentation to allow irrigants to reach the apical portions of the root canal system. This case report shows that with the GentleWave Procedure, it may be possible to clean and disinfect the apical portions of the root canal system while preserving more tooth structure.

References


