

Endodontic Management of C-Shaped Mandibular Second Premolar with Four Canals: A Case Report

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Abstract

Every tooth in the dentition can show very unique root anatomy along with variation in the number of canals in each root. The failure rate of nonsurgical root canal treatment is higher in the mandibular premolars due to difficulties in finding accessory canals explained in numerous studies. Clinicians should be aware and keep abreast with the complete assessment of the anatomy and morphology of the root canal system for a favorable treatment outcome. This case report illustrates root canal treatment for a rare case of a C-shaped with four root canals in the mandibular second premolar identified under a microscope and cone-beam computer tomography (CBCT) scan. This incidence has never been reported in the literature so far.

Keywords: Anomalous root canal anatomy, mandibular 2nd premolars, microscopes, C-shaped canal, CBCT, case report.

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INTRODUCTION

Unsuccessful root canal treatment and flare-ups were more likely to happen because of variations in root canal morphology (Mittal, Kumar *et al.*, 2014). Slowey *et al.*, (1979) stated that variations in the root canal anatomy of mandibular premolars present an endodontic challenge to treating them successfully (Slowey 1979). An extremely complex root canal system (RCS) and root morphology can be found in the mandibular second premolar with an incidence of two or more roots at approximately 0.4% (Cleghorn, Christie *et al.*, 2007). Some other etiological factors that will aid in the complexity of RCS are C-shaped canals which can be present with a prevalence of 0.6% in second premolars in a Western European population (Martins, Francisco *et al.*, 2017). Prevalence of 0.19% in the mandibular first molar and 9.1% in the mandibular second molar in a Saudi Arabian population (Alfawaz, Alqedairi *et al.*, 2019). Another study in the same population-Saudi Arabian- gives a prevalence of 4.4% in mandibular molars and 1.2% in mandibular premolar (Mashyakhly, Chourasia *et al.*, 2020). The prevalence of C-shaped canal system in mandibular

premolars in Saudi population remains not fully addressed in the literature. Mandibular premolars have on multiple occasions been stated to be the most challenging teeth to be treated endodontically, especially when they present with multiple roots or canals (Albuquerque, Kottoor *et al.*, 2014).

To achieve a successful non-surgical root canal treatment all necrotic depress and infected pulpal tissue needs to be removed (Cantatore, Berutti *et al.*, 2006), therefore basic knowledge of root canal morphology and its variation combined with using different methods like 2D radiograph, Microscopes, root canal staining, and cone-beam computer tomography (CBCT) scanning will make it easier to identify these variations (Alfawaz, Alqedairi *et al.*, 2019).

This report shows an endodontic management of a C-shaped with four distinct canals in the mandibular left second premolar identified under a microscope and cone-beam computer tomography (CBCT) scan. This incidence has never been reported in the literature so far.

CASE REPORT

An 18-year-old female patient with a non-contributory medical history and not under any medications was referred by a general dentist at the dental clinic of King Saud Medical City for root canal treatment on a mandibular left second premolar (tooth #35). Clinical examination shows that tooth # 35 is tender to percussion, with no swelling or sinus tract. Probing depths and mobility were within physiological limits. The vitality test was not applicable. A preoperative periapical radiograph revealed an abrupt loss of radiolucency in canals suggesting canal system multiplicity (Figure 1). The lamina dura was intact and no change in the apical area. The CBCT scan shows a C-shaped canal in the mid/apical third of the root going more apically the canal bifurcated twice to have a premolar with four canals, i.e. mesiobuccal, mesiolingual, and a main distal canal that split into two canals distobuccal and distolingual (Figure 2 & 3). Based on the clinical and radiographic findings, a diagnosis of “previously treated with symptomatic apical periodontitis” was made for this tooth.

On the first visit, the treatment plan was explained to the patient and after obtaining her consent, the tooth was anesthetized with 2% lidocaine (1:100,000 epinephrine). Subsequently, the tooth was isolated with a rubber dam, old gutta-percha was retrieved and the long pulp chamber was cleaned. Four canals were located with the aid of a dental operative microscope, size 10 k-file (Kerr co., Romulus, MI, USA) was used to locate the MB canal with 16mm working length, size 15 k-file was used to locate both ML and D canals with 20mm working length determined by an electronic apex locator and 2D radiographs (Figure 4). Following the working length determination, the canals were prepared with three ProTaper Universal rotary instruments (Dentsply Tulsa Dental Specialties, Tulsa, OK, USA) in the sequence recommended by the manufacturer (S1, S2, F1)

combined with copious irrigation of 5.25% sodium hypochlorite using the Endovac irrigation system (SybronEndo, Orange, CA, EUA), A cotton pellet was placed in the pulp chamber, and the tooth was temporized with cavite.

On the next visit, cleaning and shaping were completed and after the canals were dried with paper point obturation was performed with continuous wave of condensing technique. The tooth was restored with Cavite (ESPE, Seefeld, Germany) and then GIC (ESPE, Ketac, US) as temporary filling to prevent any microleakage. The final radiograph was taken (Figure 5). The patient was referred for the final restoration.



Fig 1: Preoperative radiograph of tooth #35, shows a previously treated root canal and the appearance of bifurcation of the root at the apical third

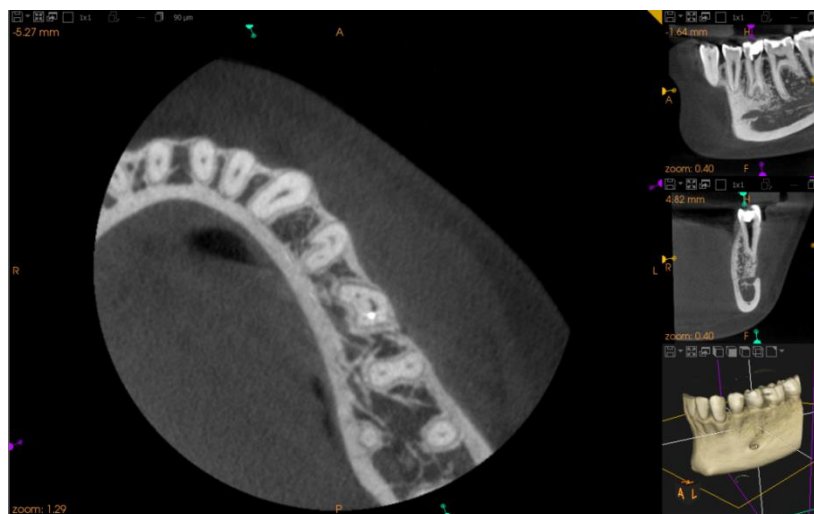


Fig 2: CBCT images demonstrate C-shaped root canals in the mandibular second premolar



Fig 3: CBCT images demonstrate C-shaped root canals in the mandibular second premolar



Fig 4: Working length estimation radiograph



Fig 5: Mesially angulated radiograph showing complete root canal obturation

DISCUSSION

More challenges may present in teeth with middle or apical third bifurcation, According to Pinherio *et al.*, 1993, A more apical position of the pulp chamber floor tends to make it more difficult to locate and obtain access to the root canals. Even though one of the canals, the one most continuous with the large main passage, is usually doable to adequate cleaning and shaping, the preparation of the other canals is often extremely difficult (Vertucci 1984).

C-shaped root canals with complex irregularities especially at the apical level were often reported. In a study done in the Thai population with a total of 1159 CBCT images, they found that 36.4% of mandibular second premolars with multiple canals had a c-shaped root canal (Thanaruengrong, Kulvitit *et al.*, 2021). In another study done in Seoul St. Mary's Hospital to evaluate the causes of endodontic failure of C-shaped root canals between 2009 to 2015, they found leaky canal was the most common cause with (45.2%) an isthmus with (23.8%) followed by missing canal with (9.5%) (Kim, Lee *et al.*, 2018). A C-shaped canal requires extra care to completely treat the canal without causing iatrogenic complications.

In cases with variations and complex morphology we will need more advanced equipment and devices that will lead to a successful treatment. For example, if we want to prevent any perforations from happening we need to keep the bur in opaque yellow dentine until the correct depth is reached any translucent or pinkish color in dentine indicates thinning dentine which means we need to stop. All this evidence and changes in colors will not be easy to see without the use of a microscope (Saunders and Saunders 1997). Another machine that will help to overcome the limitations, confirming the unusual extra canals, and understand these configurations is the use of cone-beam computer tomography (CBCT). CBCT is a contemporary, three-dimensional diagnostic imaging

system. In endodontics, it is more suitable to use a small-volume CBCT scanner these multiple slices allow us to scroll through it in real time producing dynamic images these images can be manipulated, magnified, and adjusted to our benefits (Durack and Patel 2012). It provides images of root morphology with more details than those obtained by conventional 2D radiographs which will help in improving the endodontic treatment outcomes (Patel, Dawood *et al.*, 2007).

The classification we used in this study was the one proposed by Fan *et al.* (Fan, Yang *et al.*, 2008), which classified a C-shaped root canal as a cross-sectional root canal system presenting a continuous "C" with no separation or division (type C1) or a canal shape resembling a semicolon resulting from a discontinuation in the "C" outline (type C2). In a study the more complex C1 and C2 configurations were present mainly in the middle third of the root, whereas the apical section had a majority of C2 or 2 independent oval or round root canals (Martins, Francisco *et al.*, 2017). Using CBCT technology, our case coordinate with those findings except apically it is 4 independent root canals.

C-shaped canals in particular have areas inaccessible to instruments. However, the Endo Activator uses sonic energy to facilitate irrigant movement in the root canal and enhanced penetration of the irrigant into the 'unshaped' part of the canal system (Ma, Shen *et al.*, 2015). It is recommended to use a thermoplasticized gutta-percha technic in c-shaped root canal obturation with a high flowability root canal sealer and ultrasonic activation of the root canal sealer to fill narrow areas of the root canal isthmus (Jafarzadeh and Wu 2007).

CONCLUSION

Successful nonsurgical endodontic management of C-shaped mandibular second premolar with four canals has been presented. It is a well-established fact that the presence of extra roots and root canals in these teeth may occur far more than one can expect. When performing root canal therapy you must keep in mind that radicular grooves may present relevant morphological variation in root canal system. In this case, exact root canal anatomy could not be ascertained by using periapical radiographs alone. Hence, the use of CBCT helped us in making a confirmatory diagnosis. Using the appropriate instruments and techniques will lead to the desired results.

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