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CBCT Assisted Endodontic Management of Aberrant Canal Morphology in Mandibular Second Premolar - A Clinical Perspective

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ABSTRACT

Mandibular premolars often present themselves with mystifying morphologies and have rightly earned the title of "Endodontist's Enigma". While managing such cases, a triad of three-dimensional viewing, three-dimensional cleaning and three-dimensional filling may serve as a road map for not only proper diagnosis but obtaining a predictable and successful root canal treatment outcome. CBCT as a three-dimensional tool may not only be helpful in visualizing the anatomy but also in predicting the location of multiple canals and depth of pulpal floor and bifurcation. This case report attempts to describe CBCT assisted non-surgical management of mandibular second premolar.

Keywords: CBCT, aberrant canal morphology and mandibular premolar.

INTRODUCTION

Knowledge of the root canal anatomy and awareness, recognition and understanding of the abnormal morphological presence of extra and accessory root canals contributes significantly to the successful management of root canal treatment. Management of such cases require a 3D visualization of complete root canal anatomy, thus CBCT can serve as an excellent diagnostic adjunct.[1] This case report presents a successful, nonsurgical endodontic management of mandibular right second premolar with two separate roots and three root canals where in Cone Beam Computed Tomography (CBCT) was used as a confirmatory diagnostic tool.

CASE REPORT

A 28-year-old male patient reported with chief complaint of pain in relation to #45 since three months. Clinical examination revealed proximal caries in relation to #45. There was no evidence of intra or extraoral swelling or sinus. The involved tooth was tender on percussion and tooth was non responsive to pulp sensibility testing. The preoperative periapical radiograph of the involved tooth revealed proximal caries on the distal aspect of crown involving enamel, dentin and pulp and a marked radiolucency involving the root. (Fig1a).

Fig 1(a): Preoperative IOPA Radiograph of #45

Therefore, on the basis of clinical and radiographic finding, a diagnosis of pulpal necrosis associated with symptomatic apical periodontitis was made and root canal treatment was planned. The mesio-distal dimension of the tooth appeared to be wider than normal indicating the possibility of abnormal anatomy. IOPA radiograph also revealed bifurcation of the root in the middle third with a distinct outline of the mesial and distal root. An abrupt loss of radiolucency of the canal in the distal root suggested the presence of a bifurcation or an extra canal.

In view of the complex canal system and to affirm the actual canal anatomy, CBCT was performed (Fig 2a, 2b),

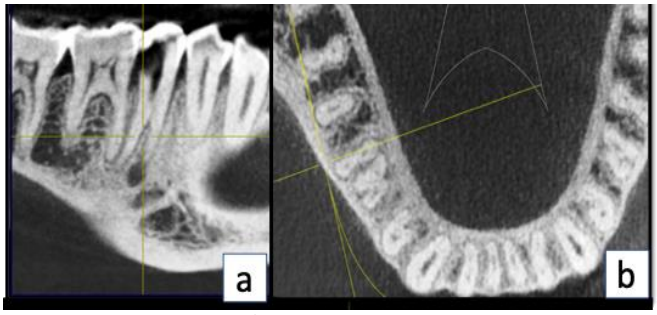
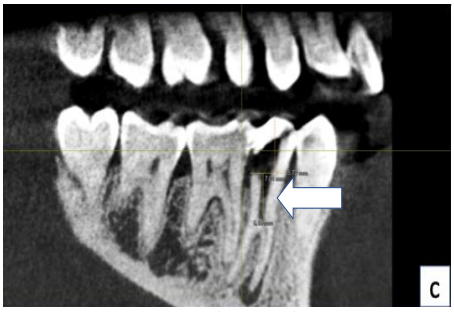


Fig 2-CBCT view of #45 (a)-sagittal view (b) –axial View

Whereby a three-dimensional view of #45 was obtained in sagittal and axial sections and the presence of a distobuccal, distolingual and a mesial canal was ascertained. Local anesthesia was administered (2% lignocaine with 1:2,00,000 epinephrine). After isolation with rubber dam, access preparation was done in #45 using Endo Access bur and Endo Z bur(Dentsply Maillefer). The location of the orifices was difficult as the floor of the pulp chamber was present in the middle third. Hence, measurement of the approximate pulpal floor depth was done using sagittal view of CBCT (Fig 2c)

which was then marked by a silicone rubber stopper on #2 Gates Glidden drill which was used to carry out pre-flaring till the level of bifurcation (midsection level). The 3-dimensional interrelationship of location of canal orifice at the level of root bifurcation was determined by CBCT and a precurved 10 K file was used with careful manual exploration to locate all the three orifices of canals. Access cavity was modified using Start X ultrasonic tips (No.1 and No.2, DENTSPLY) at 2.5X magnification using magnifying loupes and a straight-line access was established for the mesial and distal canals (Fig1b).



(c)-Measurement of pulpal floor depth by

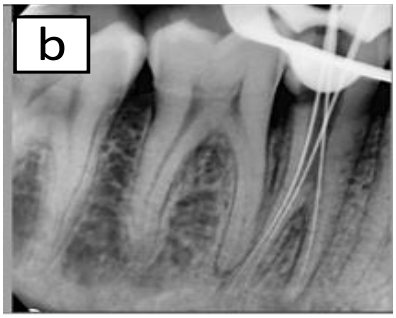


Fig 1(b): Working length radiograph of #45

Working length was measured with electronic apex locator (Canal Pro, Coltene) and confirmed with a radiograph. All the three canals were prepared using hand K-file and enlarged to the apical size of#25and the shaping was completed using Protaper Gold (Dentsply Mallifer) till 25/0.08. After each instrumentation, 5.25% NaOCl was used for irrigation and the final irrigation was performed with ultrasonic activation (Irrisafe20/.00 Acteon, Merignac, France) of 3% NAOCL for 1 min. Calcium hydroxide was then placed in the canals before placing a temporary seal with Cavit (3M ESPE AG, Seefeld, Germany). On recall after one week, patient was completely asymptomatic. After removal of temporary restoration and irrigation, root canals were dried with sterile paper points (Dentsply Maillefer, Ballaiques, Switzerland).

After radiographic confirmation, three gutta percha master cones of 25/0.08 were coated with AH Plus sealer and inserted separately into the three canals. Obturation was carried out by warm vertical compaction using the electric pluggers (sizes 50/0.05 and 60/0.06) of Calamus 3-D obturation system (Dentsply Maillefer, Switzerland). Post obturation radiograph revealed obturation of all the three canals and an additional accessory canal in apical third of mesial root (Fig1c).

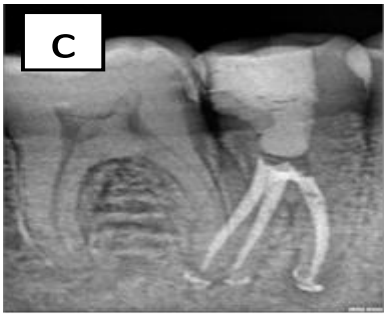


Fig 1(c): Post-Obturation Radiograph of #45

The tooth was subsequently restored with composite resin.

DISCUSSION

Mandibular premolars are one of the most challenging teeth to treat endodontically due to frequent occurrence of abnormal root canal morphology. There is a large variation in reported number of roots and canals in anatomic studies with a simple tapering canal and a single foramen being rather rare in these teeth.[2,3] The differences reported in different population groups can largely be attributed to differences in gender and ethnicity.[1]

Variations regarding the mandibular second premolar have been reported. Studies have shown that 1.2% to 34% of mandibular second premolars may show the presence of two or more canals.[4] Sert and Bayirli reported that 0.4% of mandibular second premolars have three root canals.[5]A study evaluating root canal premolar morphology of Turkish population by Vertucci reported that 2.5% of mandibular second premolars had two separate, distinct root canals with males showing a more frequency of occurrence (43%) than female patients (15%), although no case of mandibular second premolar with three root canals was found.[6]

The primary tool for evaluation of root canal morphology by clinicians has always been conventional radiography. A general guideline is that if the diameter in the mid root region appears equal or greater than the diameter of the crown in the radiograph, there are more chances of the presence of a variation in root canal configuration. If a sudden loss of radiolucency is observed or an abrupt straightening of a canal is seen, tendency of presence of extra canal in the same root or in the other independent roots increases. Yoshioka *et al.* suggested that a sudden narrowing of the canal system observed on radiograph suggests the presence of more than one canals.[7] Conventional radiograph might not provide a detailed three-dimensional view of complex root anatomies. Advancements in imaging modalities, namely micro-CT and CBCT imaging, have been proven to become indispensable analytical tools in research in the field of endodontics. Micro CT, although an excellent tool, is a less preferred method due to high radiation exposure hence CBCT was used in the present case as

an adjunct to conventional radiography.[8] CBCT is capable of providing images of high diagnostic quality with shorter scanning times and lower dosages compared with those of conventional CT scans, making it a practical tool for non-invasive and 3-dimensional reconstruction imaging for use in morphologic analysis and endodontic applications. [9] In the current case series, CBCT also proved to be a useful guide in the determination of the depth of the pulp chamber and estimation of relative three-dimensional positions of canals which helped in their identification and prevented the occurrence of iatrogenic errors such as perforations.

Although CBCT may have been reported to be an indispensable adjunct in the management of complex cases, the importance of conventional radiographs cannot be underestimated. Since CBCT cannot be performed for all cases, a careful interpretation of a conventional radiograph may hint the presence of an aberration in the canal anatomy.

Going by literature evidence, a clinical protocol can be designed to manage premolars with similar variations as mentioned in this case report. Ordinola-Zapata R*et al.* reported that pulp chamber is usually aligned in a classic buccolingual relationship. Any deviation in the alignment of pulpal floor can serve as a useful guide to predict unusual anatomy or the presence of a second or third canal.[10] The root canal system in the present case report was characterized by a complete mid-root separation of all three canals that was confirmed in the axial CBCT images.

CONCLUSION

Management of teeth with morphological variations, especially premolars present a challenge, and in such a scenario, apart from profound knowledge, keen observation and expert clinical skills, use of advanced imaging modalities like CBCT and their accurate clinical interpretation may serve as an invaluable tool in diagnosing and managing such cases.

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