Endodontic Management of a Mandibular Second Premolar with Two Roots and Four Canals - A Case Report

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ABSTRACT

A detailed understanding of root canal morphology is essential for successful root canal treatment. The mandibular second premolar usually possesses a single root with a single root canal. However, variations to this norm have been reported in the literature. This report aims to draw attention to one of such variations, and document how a successful, non-surgical endodontic intervention was performed to conserve a mandibular left second premolar with two roots and four distinct root canals which was managed for acute apical periodontitis. This report presents a case of a 28-year-old lady presenting with acute apical periodontitis of 2-weeks'duration on a 35 with a failed amalgam restoration. The tooth was tender to percussion with a metal instrument. Radiographic examination revealed a disto-occlusal radiolucency in close approximation to, & with a shortened pulp horn. The premolar had two roots in a mesio-distal direction which were fused apically. Each of these roots had two discernable root canals. There was an associated periapical reaction.

INTRODUCTION

An accurate awareness of the root form and root canal morphology is essential for successful root canal therapy as this helps in locating the canals. This also allows for the three-dimensional cleaning, shaping, and water tight sealing of these canals which is a prerequisite for successful root canal therapy.[1,2] The dentist must be completely aware of the different possible complexities the root canals can present with and as a result, they must prepare to overcome such challenging case(s). The lack of knowledge and understanding of anatomical variation can result in untreated canals which can lead to endodontic failure.[3] Hoen and Pink reported a 42% frequency of missing roots or canals in their research of teeth needing re-treatment.[4]

Mandibular premolars are unique because of the wide spectrum of anatomical variations in the root canal system and number of roots. These variations have led to them being extensively studied.[3] The extra root presents with one or more canals that may be missed, which may account for the high failure rate of treatment associated with root canal therapy of mandibular premolar teeth.[3,5,6] Clinical examination and diagnostic imaging are, thus, both essential components of the preoperative diagnosis as accurate diagnostic imaging supports the clinical diagnosis and allows the clinician to visualize possible canals.

Vertucci et al.[7] reported 97.5% of second premolars with only one root canal opening at the apex while 2.5% of the teeth studied had two canals and the incidence of three root canals were rare. Also, Wolf et al.[8] reported less than 1.5% occurrence of two rooted mandibular second premolar in their study. Though the incidence of extra root and canals is low in the mandibular premolar, it is important that clinicians always bear in mind

that variations exist in the number of roots and root canals, especially in both maxillary and mandibular premolars. This case report presents a successful, nonsurgical endodontic management of the mandibular left second premolar with two separate roots and four distinct root canals.

CASE REPORT

A 28year old female patient presented at the dental clinic, Owerri, Imo State with a spontaneous and severe toothache on the lower left quadrant of the jaw of two weeks duration. The toothache was associated with headaches, aggravated by mastication and disturbed the patient's sleep with no history of oral swellings. She had taken some oral analgesics which provided temporary relief. No significant medical history was noted. There was history of previous amalgam restoration on the affected tooth that failed.

On intra-oral examination, a disto-occlusal carious lesion was seen on the mandibular left second premolar (35), extending about two third of the crown and the tooth was tender on percussion using a mirror handle with gentle force. The mandibular first and second molars (teeth 36 and 37) were heavily restored but not tender to percussion with metallic instrument. Electric pulp tests revealed tooth 35 to be totally non-responsive. Digital periapical radiograph (Figure 1) showed two rooted tooth 35 (mesial and distal roots fused together about 3mm to the apex), with coronal radiolucency in close communication with the pulp, as well as peri apical radiolucency. Also noticed was a poorly root filled tooth 36.

Figure 1: Diagnostic radiograph of tooth 35

A diagnosis of acute apical periodontitis of tooth 35 was made. The treatment plan of two-visits non-surgical root canal treatment with post-endodontic restoration of a post-retained full-coverage porcelain fused to metal crown of tooth 35 was also made. A post retained crown was planned due to the extensive tooth structure loss. The treatment plan was explained to the patient and her consent was obtained. Root canal treatment was done under local anesthesia using Lidocaine with adrenaline (AHIL®), and moisture was controlled using cotton rolls with adequate suction. A centrally placed oval access cavity design was made with the carious lesion put into consideration. Canals were located and explored with size 10 NiTi file.

Four canals were located: mesio lingual, (ML) mesio-buccal, (MB), disto-lingual (DL) and disto-buccal (DB). The working length radiographic image (Figure 2) was exposed with sizes 10 and 15 K-files placed in the mesial and distal canals of tooth 35 with the working length determined as 21mm.

Figure 2: Working length determination radiograph

All canals were instrumented using the standardized technique of biomechanical preparation. The canal preparation was done with file sizes 10, 15, 20, and 25, at the determined working length of 21mm. Nickel-Titanium files (NiTi) were used in the canal preparation because of their flexibility in accessing the canals. Copious irrigation was

done sequentially using 3.5% sodium *hypochlorite* (NaOCL), EDTA, and normal saline to remove organic tissues and dissolve inorganic materials using a side vented irrigation needle The needle was inserted up to 2mm from the apex and slow irrigation was performed to avoid extruding irrigant to the periphery. Canals were dried with size 20 paper points, non-setting calcium hydroxide (Prime[R]) mixed with normal saline was placed in the canals as an intracanal medicament, and cotton pellets were placed on the pulp chamber as a separator before temporization. The access cavity was temporized with zinc oxide eugenol (Prime[R]) and a five-day appointment was given to fit the patient's schedule.

At the second visit, the patient was symptom free and tooth 35 was not tender to percussion with the temporary dressing intact. Zinc oxide eugenol temporary dressing and cotton pellet over the canal orifices were removed after cotton wool roll isolation. Size 20 paper point was placed in the canals to check for dryness and the canals were dried with the first paper point. File size 20 was placed in the canals at the working length and there was no tenderness within the canals. Irrigation of canals was done with normal saline to ensure softening of the intracanal medicament for ease of mechanical dislodgement. The canals were instrumented with size 25 file under copious irrigation with the working length 21mm preserved. Canals were dried with paper points and canal obturation was done with gutta percha (Gapadent[R]) and a Zinc oxide-based sealer (Prime[R]), using the single cone technique. Excess gutta percha found at the canal orifice was cut using a heated hand instrument (Figure 3a and 3b). Posterior Glass Ionomer restorative cement (Prime[R]) was used to restore the access cavity, as a medium-term restoration. Patient was scheduled for post endodontic restoration at 1 month follow up visit.

Figure 3a: Pre-obturation radiograph

Figure 3b: Post obturation radiograph

DISCUSSION

Root canal anatomical variations should be kept in mind during endodontic treatment because the presence of extra roots or canals in mandibular premolars is undoubtedly an endodontic challenge. The variation in root canal morphology has been suggested as the most likely reason for the high frequency of endodontic flare-ups and failures.[9] A study by Trope et al[10] reported that the incidence of two or more roots in mandibular second premolar tooth in African American patients was 4.8% compared to 1.5% in white Americans. Also, a higher incidence of multiple roots and canals in male patients has been reported in studies[10–12], although our case-reported patient was a female.

Cases of bilateral mandibular second premolars with two roots have been reported in Nigeria as corroborated by this case study[5,13], but second premolars with four canals are not frequently encountered in the Nigerian literature. In this case report, diagnostic periapical radiography showed the two roots of the mandibular second premolars beginning at the mid-root level with no complex internal anatomy of the tooth structure. Digital periapical radiographs were carefully inspected for root position, root form, and relative root outline. Although the use of cone beam computed tomography scan was not utilized in this study, it would have given a more precise 3D images, especially in cases where the clinician is suspecting any unusual root/ root canal morphology after routine radiographic images.

The location of extra canals in this case, though difficult, was via tactile exploration of all the walls of the major canals with a size 10 NiTi files, especially in the absence of an operating microscope. Ni–Ti files are more flexible than Stainless Steel files and have better resistance to fracture and deformation. In addition, Ni–Ti files give excellent canal outlines and retain the primary canal position.[14] Al-Fouzan[15] has suggested that a third and fourth canal should be suspected in mandibular second premolars when the pulp chamber does not appear to be aligned in its classic buccolingual relationship and, also, if the pulp chamber appears to deviate from normal configuration and seems to be either triangular in shape or too large in a mesiodistal plane, more than one canal should be suspected. In order to properly treat this tooth, it was crucial to understand both the fundamental and variant root canal architecture of the mandibular second premolar. Hence, this case report will contribute to the body of information in the Nigerian literature on the understanding of the variations in the root canal morphology of the second mandibular premolar teeth.

CONCLUSION

Mandibular premolars with extra roots and/or canals pose a particular challenge, but this case report presents a successful endodontic treatment of a mandibular second premolar with four canals. Successful endodontic treatment requires adequate knowledge of the anatomy of root canals, clinical skills and proper radiographic assessment.

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