

## Recognition, Diagnosis and Endodontic Management of Mandibular Second Premolars with Variant Morphology: A Series of Case Reports

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### ABSTRACT

**Background:** It is very important to understand the variations in the root canal morphology to achieve successful outcome of the endodontic treatment. Teeth with aberrant morphology often present challenge in clinical management. The article presents a series of clinical case reports of mandibular premolars with additional root canals and the procedural steps of endodontic management. It also emphasizes the recent advances in diagnosis and treatment procedures.

**Keywords:** Mandibular premolar, variant morphology, root canal anatomy.

### INTRODUCTION

The successful outcome of root canal therapy not only depends on appropriate cleaning and shaping, but also lies in thorough understanding of the root canal anatomy and its variations. Acute flare ups or post treatment failures may be encountered following the lack of understanding of the root canal morphology. Mandibular premolars are often considered an 'enigma' to the Endodontists as they pose difficulty to perform endodontic treatment due to their intricate internal anatomy. Vertucci reported that the mandibular first premolar had one canal at the apex in 74.0% of the teeth, two canals at the apex in 25.5% and three canals at the apex in 0.5% of the teeth. The mandibular second premolar had one canal at the apex in 97.5% and two canals at the apex in 2.5% of the teeth [1]. Hasselgren reported a higher prevalence of presence of additional canals in males compared to females in mandibular premolars [2]. Root canal morphology also variegates in different ethnic groups. Troupe et al. in their study reported an

incidence of two canals in 5.5% of Caucasians and 16.2% in the African American group [3]. It is therefore important for the clinician to be aware of the key anatomical features and diverse canal configurations that may be encountered in the mandibular premolars so as to facilitate appropriate modifications in the treatment protocol.

### CASE REPORT 1

A 28 year old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the lower left back tooth region since three days. On clinical examination, the left mandibular second premolar revealed deep dental caries involving the pulp space. The tooth was tender upon percussion and gave a negative response to pulp testing. Based on clinical and radiographic findings a diagnosis of symptomatic irreversible pulpitis was confirmed. Endodontic therapy was planned. Preoperative diagnostic radiographs were taken at angulations 45°, 90° and 110° which revealed two separate

Received: Dec. 11, 2018: Accepted: Jan. 25, 2019

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Fig 1a: Pre-operative radiograph showing bulbous/extra root outline indicative of variant root canal anatomy (35).



Fig 1d: Post-operative radiograph (35).

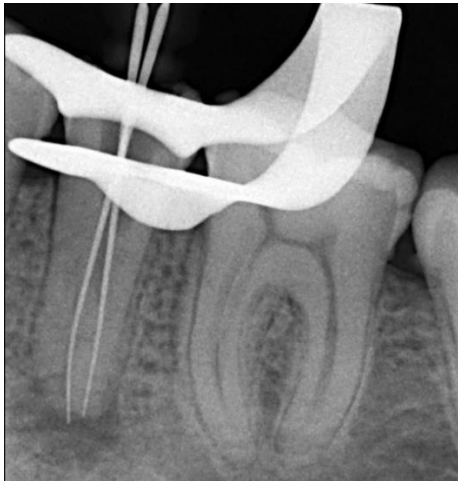


Fig 2b: working length radiograph with ISO 15# K files placed in the canals (35) (Vertucci type IV)



Fig 2a: Pre-operative radiograph (45).



Fig 1c: Master cone radiograph (35).

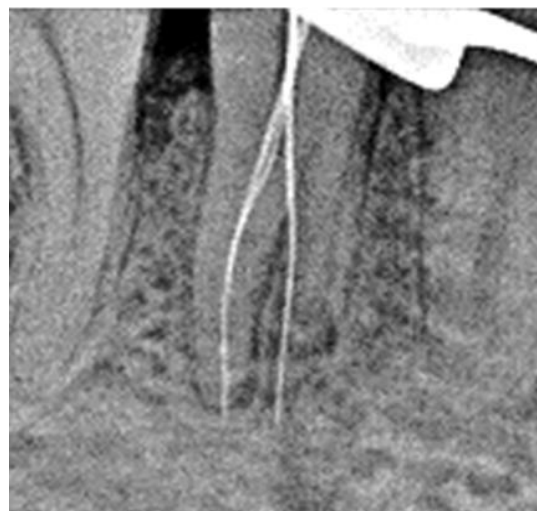


Fig 2b: Working Length radiograph with ISO 15# K files placed in the canals (45) (Vertucci Type IV).

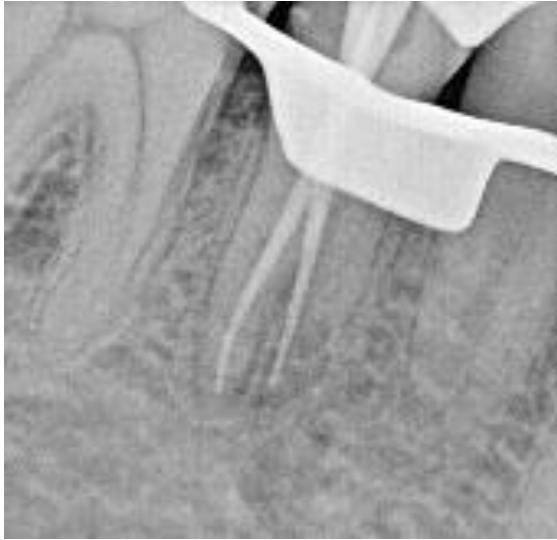


Fig 2c: Master cone Radiograph (45).



Fig 3a: Pre-operative Radiograph Showing a large lateral radiolucency (45).



Fig 2d: Post-operative Radiograph (45).



Fig 3b: Working Length Radiograph with ISO 15# K files placed in the canals (45) (Sert and Bayirili Type IX).



Fig 2e: 6 Months Follow-up Radiograph (45).



Fig 3c: Master cone selection (45).





Fig 3d: Obturation (45).

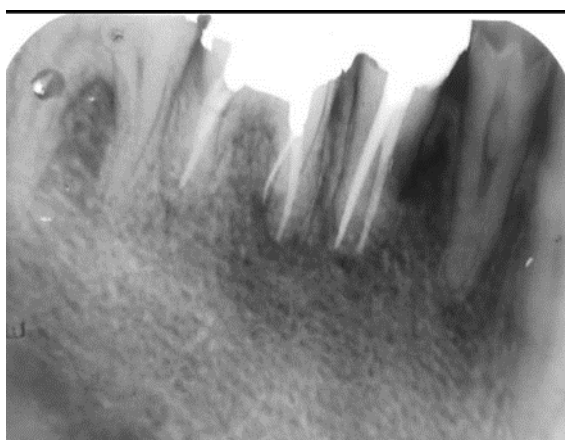


Fig 3e: 6 months follow up showing Resolution of lateral radiolucency (45).

root-canals in relation to the mandibular second premolar [Figure 1A]. The patient was informed about the procedure and his consent was obtained. Anesthesia was achieved using 2% lignocaine with 1:80,000 dilution adrenaline (LIGNOX, INDOCO REMEDIES LTD). Under rubber dam isolation, the endodontic access cavity was prepared using Endo access burs (EZ, DENTSPLY) [figure 1B]. Working length determination was done by Ingle's method [figure 1C]. The root-canals were instrumented to the working length using Pro-Taper gold files (DENTSPLY) using the sequence S<sub>x</sub>, S<sub>1</sub>, S<sub>2</sub>, F<sub>1</sub> and F<sub>2</sub> and with irrigation of EDTA and 5.25% sodium hypochlorite solution with ultrasonic irrigator, BIOSONIC UC150 (COLTENE), of tip diameter 0.3mm. Intracanal calcium hydroxide medicament was placed and patient was recalled for completion of the procedure. In the subsequent visit, master cone was selected [figure 1D] and obturation was carried out by warm vertical compaction of

guttapercha cones with AH Plus sealer (DENTSPLY). A post obturation radiograph was taken and coronal access cavity was restored with light cure composite resin [figure 1E]. The patient was recalled for follow-up. Both clinical and radiographic findings during the follow-up visit were satisfactory, suggestive of periapical healing and repair.

## CASE REPORT 2

A 25 year old male patient presented to the Department of Conservative dentistry and Endodontics with a chief complaint of mild pain and discomfort in the lower right back tooth region since 15 days. Based on clinical and radiographic examination, a diagnosis of chronic irreversible pulpitis was made. The preoperative diagnostic radiograph revealed aberrant canal morphology in relation to the lower right second premolar [figure 2a]. After obtaining the informed consent from the patient, the endodontic treatment was initiated. The tooth was anesthetized, under rubber dam isolation the endodontic access cavity was prepared and canals were located separately. De-roofing the pulpal chamber revealed a bleeding spot (red line test), which upon exploration using DG16 explorer (HU-FRIEDY) was found to be an additional canal. ISO 15# K files (DENTSPLY) were placed in the canals (buccal and lingual) to the tentative working length and an intraoral radiograph was exposed [figure 2b]. The canal divided into two different canals at mid-level of the root approximately 6mm from the CEJ

Magnification loupes of 3.5x magnification (CARL ZEISS) were used to enhance the visibility. Cleaning and shaping of the canals was performed using Pro-Taper Gold files. Master cone was selected and canals were obturated using warm vertical compaction technique [figure 2c]. Post endodontic restoration was provided with light cure composite resin [figure 2d]. Patient was followed up regularly [figure 2e] and the patient remained asymptomatic in all recall examinations.

## CASE REPORT 3

A 34 year old male patient presented to the Department of Conservative dentistry and Endodontics with a chief complaint of pain in the lower right back tooth region since 1 week. The

patient gives a history of previous root canal treatment in the lower right quadrant one year ago. Upon clinical examination the mandibular right second premolar was tender upon percussion. Radiographic examination revealed obturated root canal with a large lateral radiolucency and periapical radiolucency (figure 3a). Suspecting a missed canal, re-treatment was initiated. Gutta-percha was removed from buccal and lingual canals using Gutta-percha solvent (RC SOLV, PRIMEDENT) and Pro-taper retreatment file (D0-D3, DENTSPLY). Upon exploration, a third canal was located mesiobuccally approximately 4mm below the level of the CEJ.

The working length was determined using Electronic apex locator (ROOT Zx MINI- JMORITA) and was verified radiographically (figure 3c). Cleaning and shaping of the canals was done using ProTaper Gold files (DENTSPLY) with copious irrigation using 5.25% sodium hypo-chloride solution. Obturation of the canals was done using warm vertical compaction technique and resin sealer AH Plus (DENTSPLY) (Figure 3d) and the coronal access was restored using light cure composite resin. During the follow-up appointment after 6 months, the radiographic examination revealed resolution of periapical radiolucency (figure 3e) suggestive of osseous healing and repair.

## DISCUSSION

The need to familiarize with irregularities, complexities and aberrations which are likely to occur in the root canal system must be recognized to effectively treat these canal intricacies. Hoen and Pink reported 42% incidence of missed canals or roots in teeth requiring retreatment [4]. Slowey et al (1979) stated that variations in root-canal anatomy of mandibular premolars present an endodontic challenge to treat successfully [5]. A study by University of Washington that assessed the failure rate of non-surgical root canal treatment in all teeth revealed the highest incidence in mandibular premolars [6]. The possible reasons are the variations in the root canal morphology. Frequent existence of bifurcated canals in the mandibular premolars occurs at different levels. Careful tactile exploration of the root canal system with hand files, change in the horizontal angulation of the X-Ray tube can be used to detect the presence

of additional canals. Martinez-Lozano et al stated that a change in the horizontal angulation by 40° is helpful in the identification of extra canals [7]. A “fast break” of the canal in the radiographs may represent the presence of an additional canal [8]. Further, the file placed up to the working length tends to appear off-centre in the radiograph [5]. The other methods include the use of magnification loupes, red line test, dentinal mapping, staining techniques, champagne test with the use of NaOCl, visualization endogram using Ruddle’s solution and modern diagnostic advances like CBCT. Modification in the access cavity preparation might be necessary to obtain a straight line access to the additional canals. Disinfection with NaOCl has good tissue dissolution and proteolytic action. When agitated passively with an ultrasonic irrigator, it helps in effective removal from the un-instrumented parts of the root canal system. Endodontic loupes are an important adjuvant in contemporary clinical practice and it is gaining popularity among endodontists. The main advantages are it improves visualization, quality and precision of treatment and enhances ergonomics. The current case series illustrates the correct identification and management of extra canals in mandibular premolars and emphasizes the significance of understanding their internal anatomy with precision.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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