World Journal of Dental Excellence 2025, DECEMBER, Vol. 1 No. 2 : 21-26.
CASE SERIES
World Journal of Dental Excellence

# Endodontic management of mandibular premolars with aberrant root canal morphology: Case Series

**Swathi Shankrappa[1] | Vedavathi Boregowda[2] | Ranjini M Aswathnarayana[3] | Dharam M Hinduja[4] | Geetha Vanniyakula[5]**

[1]Post Graduate Student,Department of Conservative Dentistry and Endodontics, Dayananda Sagar College of Dental Sciences, Bengaluru, Karnataka, India

[2]Professor and HOD, Department Of Conservative Dentistry And Endodontics, Dayananda Sagar College of Dental Sciences, Bengaluru,Karnataka, India

[3]Professor, Department Of Conservative Dentistry And Endodontics, Dayananda Sagar College of Dental Sciences, Bengaluru,Karnataka, India

[4]Professor, Department Of Conservative Dentistry And Endodontics, Krishnadevaraya College of Dental Sciences, Bengaluru,Karnataka, India

[5]Post Graduate Student, Department Of Conservative Dentistry And Endodontics, Dayananda Sagar college of Dental Sciences, Bengaluru,Karnataka, India

**Correspondence**
Swathi S, Department Of Conservative Dentistry And Endodontics, Dayananda Sagar College of Dental Sciences and Hospital, Bengaluru, Karnataka, India. 560111
Email: **swathi.srnandan@gmail.com**

## Abstract

**Background**: Intricate research into the internal anatomy of teeth has revealed myriad variations in root canal configurations. The mandibular premolar's root canal system is one such tooth with complexities that usually requires special management skills in root canal treatment. Proper knowledge of the root canal anatomy, diligent radiographic interpretation and clinical inspection is essential for successful root canal treatment of the mandibular premolars. Skillful and specific root canal preparation and obturating techniques are usually needed. **Methods**: This paper reports two unusual cases of atypical root canal morphologies in mandibular premolars. The first case is a mandibular first premolar with Vertucci type V configuration and the second case is a mandibular second premolar with C shaped root canal both of which were successfully managed endodontically. **Results**: The use of CBCT (Cone beam computed tomography) and magnification has greatly helped in diagnosis and management of these cases. **Conclusion**: The case series describes the morphological variations found in mandibular premolars which were diagnosed and managed with the help of diagnostic aids like CBCT and dental operating microscope for the success of endodontic therapy.

**KEYWORDS**
Cone-Beam Computed Tomography, Dental Pulp Necrosis, Premolar

## 1 | INTRODUCTION

The successful outcome of an endodontic treatment demands thorough knowledge of the internal anatomy and morphology of the root canal system. The risk of missing canal anatomy during root canal treatment is high because of the complexity of the root canal system. Accurate location of root canals is paramount in the success of endodontic therapy. Anatomical variations, especially extra canals and roots, should always be kept in mind when treating teeth endodontically.[1] Missed canals or inadequate cleaning and shaping of these extra canals would lead to the failure of endodontic treatment.[2] Slowey stated that the complexities present in premolars make them the most difficult to treat due to their failure rates. Mandibular premolars usually have a single root with a single oval canal; however, variations do exist, such as multiple roots and multiple canals.[3] The mandibular premolars often have variations and complexity in the canal system. The abnormal morphology of these mandibular premolars makes it difficult to find and negotiate the additional canals; failure to identify other canals often leads to unsuccessful root canal treatment. CBCT scanning provides a greater advantage in assessing the complexity of root canal morphology and planning an appropriate endodontic treatment for the same. Magnification drastically enhances visualization and management of root canal aberrations. Pre-curving of the files, tactile sense of the operator and

repositioning of the subsequent files in the same direction helps one to negotiate and instrument these canal aberrations thoroughly.[4] This case report aimed to demonstrate the successful endodontic management of unusual anatomy of a mandibular first premolar with Vertucci type V configuration and a mandibular second premolar with C shaped canal configuration.

## 2 | CASE 1 – MANDIBULAR FIRST PREMOLAR WITH TYPE V CONFIGURATION

**Case history & examination**: A 38-year-old female patient reported with a chief complaint of pain in the lower right back tooth region since 1 month. On intraoral examination, disto-proximal deep dentinal caries was noted in relation to 44 and the tooth was tender on percussion. The tooth did not respond to Cold test (Endofrost spray- Coltene) and electric pulp testing (EPT). On radiographic examination, disto occlusal radiolucency involving enamel, dentin and pulp was noted. There was widening of the periodontal ligament and loss of lamina dura. We also noted a fast break phenomenon which gave indication of an extra canal.

**FIGURE 1** Preoperative radiograph-44

**Methods**: For a better understanding of the root canal morphology, CBCT (Cone Beam Computed Tomography) with respect to 44 was taken (Carestream CS 8200). On sagittal view it revealed Vertucci type V configuration (single canal bifurcating buccally and lingually at the junction of middle and apical third) with respect to 44. Also, periapical radiolucency measuring about 2mm by 3 mm was detected and deep mesial and distal radicular groove noted at the apical third of the root.

Hence, the tooth was diagnosed as pulp necrosis with symptomatic apical periodontitis with respect to 44. After anesthetising and rubber dam isolation, caries removal was done and access opening performed with endo access bur No 2. Canal was negotiated with no 8 K file followed by no 10 K file by precurving the file. Working length was determined by using apex locator(J Morita Root ZX Mini) and confirmed radiographically.

**FIGURE 2** CBCT showing Vertucci type V-Buccal and Palatal canal

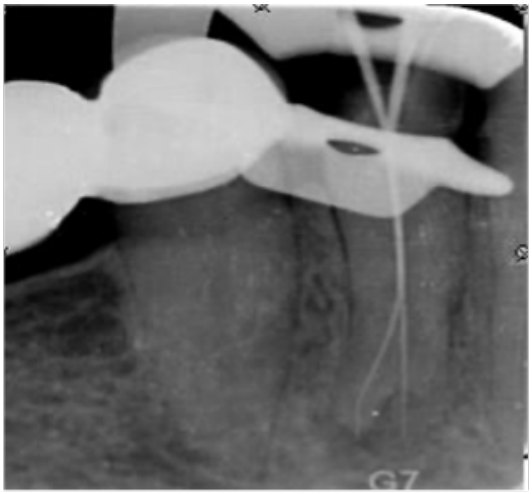

**FIGURE 3** Working length radiograph

Since radiograph taken with 20-degree mesial angulation aided in better visualization of both the canals, this angulation was used for all the radiographs. Cleaning and shaping upto 30 04% (Neo Endo S, Orikam, India) rotary file was followed. Irrigation with 3% NaOCl and saline were used throughout the procedure.

Sonic activation of the irrigant was done for 1 min. Rinsing was done with 17% EDTA for 1 min, flushed with saline and final rinse was performed with 2% CHX (Chlorhexidine). Aqueous calcium hydroxide intracanal medicament was placed for 2 weeks. In the subsequent visit, patient was asymptomatic and the tooth was non-tender. Intracanal medicament was removed with sonic irrigation and dried with absorbent points. A final rinse was done with 17% EDTA. Master cone fit was checked and confirmed in radiograph and obturation was done

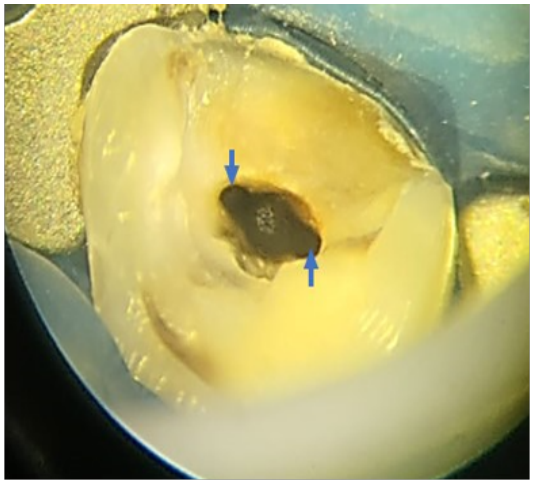

**FIGURE 4** Canal at 25x magnification after BMP

with gutta-percha and Bioceramic sealer (Seal max plus, Maarc dental) using lateral compaction technique.

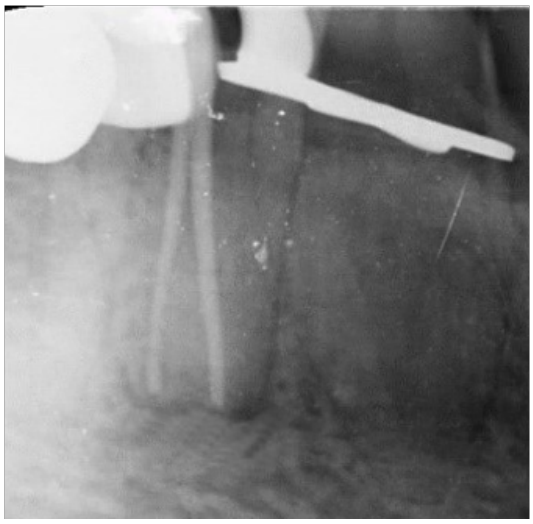

**FIGURE 5** Master cone selected

Since less than 50% of sound coronal tooth structure was present, Fiber post (Self Post, Medicept) was luted with self-adhesive resin cement. Post endodontic restoration was done with composite and crown was fabricated and cemented (Figures 6 and 13). A follow up visit was conducted 6 months later. Patient was clinically and radiographically asymptomatic.


**FIGURE 6** Obturation of 44

## 3 | CASE 2: C SHAPED CANAL IN MANDIBULAR SECOND PREMOLAR

Case history/examination: A 25-year-old male patient reported with a chief complaint of pain in lower right back tooth region since 3 days. On intraoral examination, deep disto occlusal caries in relation to 45 was observed and tooth was tender on percussion. On Cold test and EPT normal response was noted. On radiographic examination, disto occlusal radiolucency involving enamel, dentin and pulp with complex root canal anatomy and pdl widening was noted wrt 45.

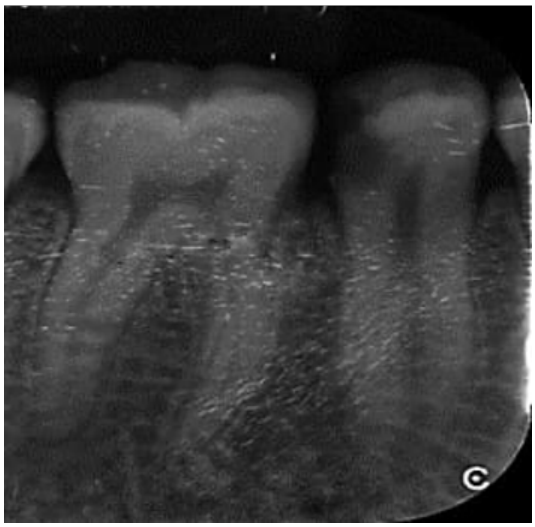

**FIGURE 7** Pre operative radiograph

It was diagnosed as symptomatic irreversible pulpitis with symptomatic apical periodontitis wrt 45. Methods: Root canal treatment was initiated and during canal negotiation multiple deviations of the file were noted each time the file was inserted. Hence, for better understanding of the canal anatomy a CBCT of 45 was taken (Carestream CS

8200). The Axial and Coronal view revealed a C shaped root canal starting from middle third to apical third. Access cavity preparation (Endo access bur-Dentsply) was refined under rubber dam isolation. Canal orifice was enlarged and patency of the canal was achieved using size #10 K files. Working length was determined using electronic apex locator (J Morita Root ZX Mini) and verified radiographically. Circumferential filing was done till 25K and H file and then rotary instrumentation till 25 04% (NT rainbow S file, Nineten, India). Irrigation was done with 3% sodium hypochlorite followed by 17% EDTA throughout the procedure with intermittent saline rinse. Passive ultrasonic activation was done and final rinse was with 2%Chlorhexidine. Master cone was selected and lateral compaction obturation was done with GP and Seal Max Plus sealer.Since there was less than 50% of the remaining tooth structure Everstick post (GC,Australia) was customized and placed after post space preparation and post endodontic restoration was completed. Patient has been recalled for the crown.

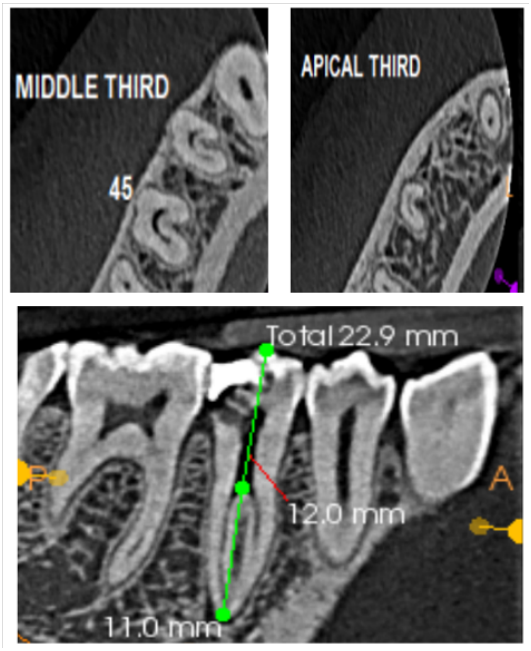


**FIGURE 8** CBCT showing C shape configuration-45

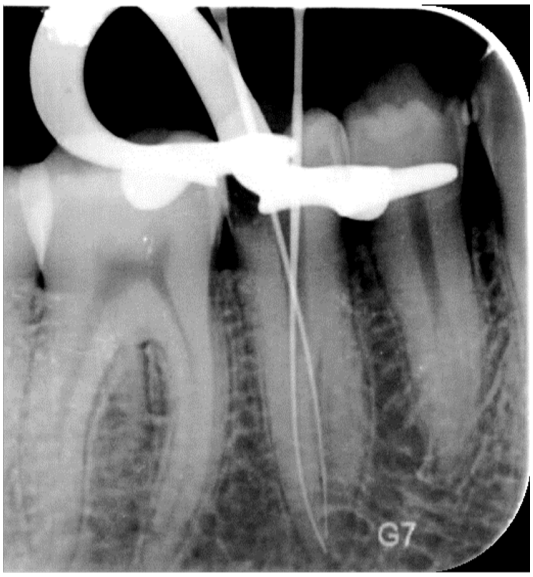


**FIGURE 9** Working length


**FIGURE 10** Obturation of 45

## 4 | DISCUSSION

Complexities of the mandibular premolar's root canal anatomy have been shown in the literature to be not uncommon findings. A study at the University of Washington assessed the failure rate of non-surgical root canal therapy in all teeth. The mandibular first premolar had the highest failure rate in the study at 11.45%.[5] A literature review done on mandibular premolars by Cleghorn et al. concluded that 2.1% had more than one root and 24.2% of the premolars had two or more canals.[6] Patel et al. studied the root canal morphology of mandibular premolars in Indian population, it was concluded that majority of premolars had type I configuration i.e. 78% and second common configuration was type V.[7] In a CBCT study done on South Indian population presented Type I Vertucci's canal morphology as the most common in mandibular first and second premolars followed by Type V (11%) and C shaped configuration (1%).[8] Usually C-shaped canal configuration has been shown to have a high prevalence in mandibular second molars followed by maxillary and mandibular third molars but this anatomy also has been reported in the mandibular premolars with a rare incidence of 1-2%.[9] Cone beam computed tomography (CBCT) is an exquisite diagnostic modality for


**FIGURE 11** Post space preparation

**FIGURE 12** Everstick post cementation and post endodontic restoration

three-dimensional view of the teeth with complex root canal anatomy. Dental operating microscope as well as radiographic examination along with CBCT imaging were used to facilitate accurate diagnosis of the root canal configuration, which consequently led to the successful endodontic management of this case. Obturation of these atypical root canal systems is demanding, cold lateral condensation was used as it has a better length control and it does not cause undue forces on the thin dentin at the furcation region or the isthmus region, especially in

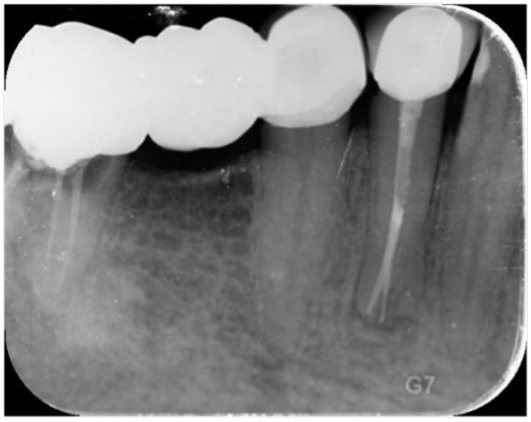


**FIGURE 13** Post operative radiograph-straight angulation


**FIGURE 14** Post operative radiograph-mesial angulation

the second case. Use of Bioceramic sealers provide an added advantage of better periapical tissue repair owing to antimicrobial property and alkalinity and calcium deposition.[10] Hence, bio ceramic sealer was used for obturation. Placing prefabricated post in C shape root canal is a challenge as there is chance of strip perforation and also it does not adapt well to such an anatomy.[11] Everstick post can be adapted well to the any canal anatomy, it has modulus of elasticity similar to dentin and transmits stresses along the dental walls laterally.[12] There is less stress accumulation at the weak isthmus region, hence it was used to reinforce the tooth in the second case.

## 5 | CONCLUSION

The mandibular premolars anatomy has complex variations. Sound anatomical knowledge background, detailed clinical investigations, proper utilization of advanced radiographic imaging and magnification tools are mandatory for best understanding, visualization and management of aberrant mandibular premolar internal anatomy.

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**How to cite this article:**
Shankrappa S, Boregowda V, Aswathanarayana M R, Hinduja DM, Vanniyakula G. Endodontic management of mandibular premolars with aberrant root canal morphology: Case Series. World J Dent Excell. 2025;1(2):21-26.