

# Endodontic management of a Radiculous Maxillary first premolar using CT Scan as a diagnostic aid

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## ABSTRACT:

Detection of anatomical variations of teeth is essential for clinical success. Usually maxillary first premolar have two roots. The possibility of three roots in maxillary first premolars is quite low; however, it must be considered radiographically and clinically during endodontic treatment. Access cavity modifications may be required for stress free entry to complex anatomy. Higher magnification and advanced diagnostic aid such as CT scan can be useful for exploration of additional roots or root canals.

This case report describes diagnosis of maxillary first premolar with 3 separate roots using CT scan and its endodontic management.

**Key words:** Anatomical variations, Maxillary first premolar, CT scan Three roots, Higher magnification, Radiculous.

## INTRODUCTION

The variability of root canal system in premolars pose a constant challenge to endodontic diagnosis and treatment. A thorough knowledge of internal and external anatomy, coupled with a correct diagnosis and appropriate cleaning and shaping of the root canal system followed by hermetic filling, will lead to a successful treatment outcome.

Root canals are left untreated if the dentist fails to identify their presence, particularly in teeth that have anatomical variations or additional root canals.<sup>1</sup> Even treatment of uncomplicated multirooted teeth requires knowledge of the most frequent anatomical formations and of possible variations. Extra roots are an additional challenge, which begins at case assessment and involves all operative stages, including cavity design, canal access, and localization, cleaning and shaping of the root canal system.<sup>2</sup>

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Maxillary first premolar exhibits the greatest variation in root anatomy and root canal morphology.<sup>3</sup> It typically has two well-formed roots (56%) that divide in the middle third of the root and lie buccal and lingual to one another. About 40% have only one root containing two canals that then unite in a common foramen.<sup>4</sup> Also maxillary premolars have highly variable root canal morphology. Three-rooted maxillary first premolars are uncommon (0.5-6%)<sup>5-9</sup> and frequently have one canal in each of three roots.<sup>10</sup> The anatomy of maxillary premolars with three root canals, mesiobuccal, distobuccal and palatal, is similar to that of adjacent maxillary molars, and they are therefore sometimes called small molars or radiculous.<sup>11-12.</sup>

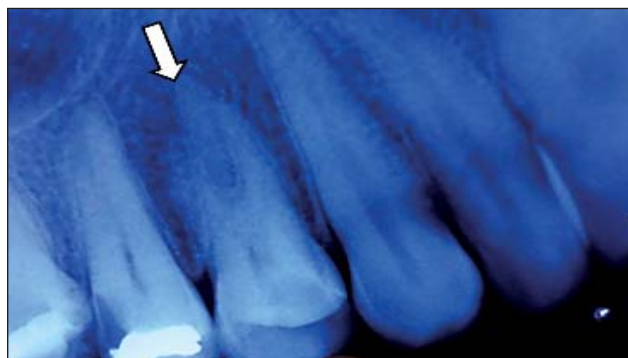
The radiographic image is a 2 dimensional representation of a 3 dimensional object. The ideal method of precise determination of the root canal morphology of a tooth is serial sectioning of the tooth, which is impractical in clinical situations. Therefore other diagnostic method like spiral computed tomography (CT) is useful in such conditions to determine the root canal morphology.<sup>13</sup> CT data offer significant advances in the ability to reconstruct with optimum details of the tissues before and after instrumentation and obturation, they also remain fully retrievable for future evaluations.<sup>14</sup>

This case report describes diagnosis of three-rooted maxillary first premolar with the help of spiral CT & its endodontic management.

## CASE REPORT

A 30 year old male patient reported to the Department of Conservative Dentistry and Endodontics, PMNM Dental College and Hospital, Bagalkot, Karnataka. for the treatment of painful right maxillary first premolar tooth. His medical history was noncontributory. Clinical evaluation revealed right first premolar with mesio-occlusal caries that did not respond to electric pulp testing. The tooth was tender on percussion. The diagnosis was made as acute apical periodontitis with right maxillary first premolar.

The radiographic examination of the tooth revealed two buccal roots (mesiobuccal and distobuccal) and one palatal root. To confirm the presence of three roots CT scan was done.



**Fig. 1.** Periapical radiograph, showing the complex root morphology of the premolar suggesting the existence of three roots

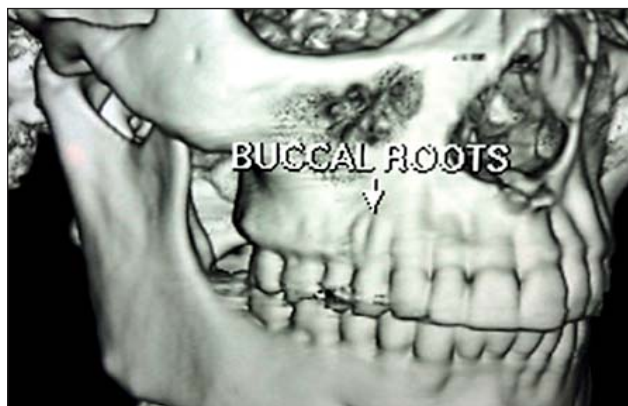
CT Scan was done with a multi-detector CT scanner (16 slices/second), as per recommendations given by Christoph et al.<sup>25</sup> to reduce radiation dosage (collimation, 1mm; pitch, 2; tube voltage, 80 kv; tube current, 40 mA). Also all the protective measures were taken to protect the patient from radiation. The scan reconstruction interval was 0.8 mm, resulting in 60-100 overlapping images. CT scan slices revealed three separate roots each having single canal for right maxillary first premolar. The slices of premolar were obtained at different level to determine the canal morphology.



**Fig:2** A B C

**Fig. 2.** Spiral CT image of the maxillary first premolar.

- A, At the level of coronal third of the root.
- B, At the level of middle third of the root.
- C, At the level of apical third of the root.



**Fig. 3.** Three-dimensional CT image

The patient was anesthetised by periapical infiltration (2% lignocaine with epinephrine (1:80000). The tooth was isolated with a rubber dam. All the caries was removed and access to the pulp chamber was completed. Two buccal canals and one palatal canal were found as shown by the initial radiograph and CT scan.



**Fig. 4.** A picture of access cavity showing the triangular settlement of the three canal orifices.

The working lengths were estimated using an apex locator and working length radiograph was taken with 15# K-files (Kerr Manufacturing Co., Romulus, MI) .



**Fig. 5.** Radiographical confirmation of three root canals and determination of the working lengths

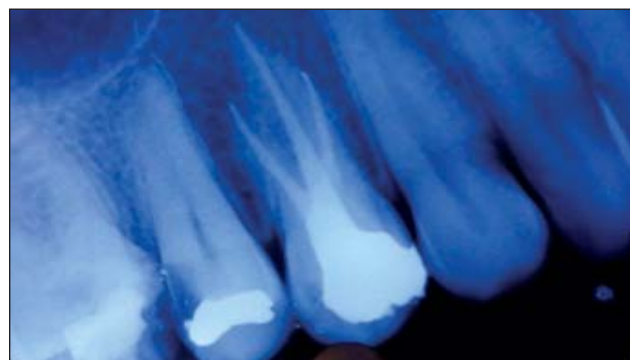
The three canals were prepared manually by step-back technique with K-Files using copious 2.5% sodium hypochlorite irrigation. The canals were dried with sterile paper points and temporized with cotton pellets and IRM (Caulk/Dentsply Milford, DE).

Approximately 1 week later, the patient was free of pain; all the canals were irrigated, dried, and radiograph was taken with Gutta percha master cones (Fig. 6)

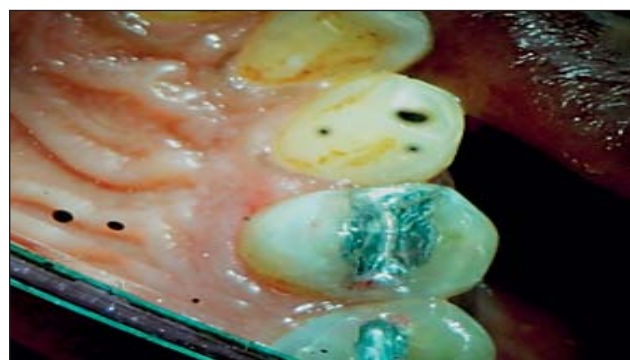


**Fig. 6 :** IOPA Radiograph of Master cone selection

The master apical K file in all canals was an ISO size 40. The canals were obturated with Gutta percha by lateral condensation using AH Plus sealer (Dentsply, De Trey, Konstanz, Germany) and a postobturation radiograph was taken. The permanent restoration of tooth was done with silver amalgam.



**Fig. 7.** Periapical radiograph after



**Fig. 8:** Permanent restoration with obturation of the three root canals Silver Amalgam

When the patient was reviewed after 6 months the tooth was asymptomatic with Clinical and Radiographic findings within normal limits.



**Fig. 9** : Periapical radiograph after 6 months.

## DISCUSSION

For a successful root canal treatment, it is essential to reach, clean and shape the root canals properly before a hermetic filling. Root canal treatment has shown that the tooth anatomy is highly variable. Many of the difficulties found in root canal treatment are due to this variation in root canal morphology.<sup>2</sup>

The possible anatomic configurations of maxillary premolars are well documented in different populations.<sup>3,8-10, 15-17</sup> But, in the literature only a few cases related to three rooted maxillary first premolar teeth (were presented).<sup>18-22</sup>

Our case has described the diagnosis and clinical management of first premolars with three canals and three separate roots.

Visualization of three-canaled maxillary premolars on preoperative radiographs can often be difficult. This root canal configuration resembles that of a miniature three-canaled maxillary molar; the canals being classified as the mesiobuccal, distobuccal, and palatal canals. Often it is helpful to examine radiographs of contralateral teeth when suspecting complex root canal configurations.<sup>20</sup> But, in the present case report, on contralateral maxillary first premolar tooth's periapical radiograph was not observed with three root.

Diagnostic measures such as multiple pre-operative radiographs, RVG, CT scan, examination of pulp chamber floor with a sharp explorer, Troughing of grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the NaOCl 'champagne bubble' test and visualizing canal bleeding points are important aids in locating root canal orifices.

Walton recommended the use of two diagnostic radiographs to disclose missed canals. If a

radiograph shows a sudden narrowing or even a disappearing pulp space, the canal diverges at that point into two parts that may either remain separate or merge before reaching the apex. If an eccentric orifice found, at least one more canal is present and should be searched for on the opposite side. A third canal should be suspected clinically when the pulp chamber does not appear to be aligned in its expected bucco-palatal relationship. Additionally, 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 root canal should be suspected. Pulp cavity of each tooth shows high variability that makes the endodontic treatment unique.<sup>23</sup>

In three rooted maxillary premolar, the buccal orifices are close to each other that are hard to locate. In treatment of three rooted maxillary first premolars, Balleri et al. suggested a T-shaped access outline. This modification allows good access to the two buccal canals.<sup>24</sup>

Clinicians should be aware of anatomical variations in maxillary and mandibular premolars and be able to apply this knowledge in radiographic and clinical interpretation.

Radiographic image is a shadow and has the elusive qualities of all shadows. Also it is a 2D representation of a 3D object so for better understanding of complicated canal morphology

CT scan was done. It greatly facilitate access to the internal root canal morphology. SCT scans acquire raw projection data with a spiral-sampling locus in a relatively short period. Without additional scanning time, these data can be viewed as conventional transaxial images, such as multiplanar reconstructions or as 3D reconstructions. With SCT scans, it is possible to reconstruct overlapping structures at arbitrary intervals and thus the ability to resolve small subjects is increased.

Tachibana and Matsumoto<sup>26</sup> studied the applicability of CT to endodontics. They concluded that this method allowed the observation of the morphology of root canals, the roots, and the appearance of the tooth in all the direction. Moreover the image could be analyzed, altered and reconstructed by the computer. A major concern with the use of CT scan is its high radiation dosage. In the present study, guidelines by Christoph et al were used.<sup>25</sup> With these guidelines the effective radiation dosage produced by this method was 0.56+/- 0.06

mGy, which is equivalent to a standard panoramic radiograph.

When confronted with unusual tooth anatomy as three rooted maxillary premolars, good illumination and magnification can make treatment easier. With the aid of an operating microscope or loop it is possible to locate all the root canal orifices.

In the present case report, when the patient was reviewed after 6 months, The tooth was asymptomatic with clinical and radiographic findings within normal limits. Further recalls will be continued for prognosis of this clinical case.

As a result, the knowledge of variations will assist the dentist in reaching conclusions when diagnosing and treating complicated endodontic cases. The possibility of presence of multiple canals and additional roots in cases should be carefully explored and treated.

#### CONCLUSION:

Endodontic success in teeth with the number of canals above that normally found requires a correct diagnosis and careful inspection. Morphological variations in pulpal anatomy must be always considered before beginning treatment. Careful clinical and radiographical examination and newer diagnostic methods such as CT Scan is essential for successful endodontic diagnosis and treatment.

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