

## Case Report

### Endodontic Management of a Maxillary Second Premolar with Three Roots and Three Canals in a North Indian Patient: A Case Report

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#### ABSTRACT:

Maxillary second premolars generally present with a single root and two root canals. However, literature suggests that this tooth may harbour a more complex internal and external anatomy. Though, the occurrence of three roots and three canals in maxillary second premolars is extremely rare, their presence challenge the conventional perceptions and treatment approaches. A thorough radiographic and clinical examination are mandatory for accurate diagnosis. Recent advances like Cone Beam Computed Tomography (CBCT) and Dental Operating Microscope (DOM) aid in understanding and negotiating the intricate root canal anatomy. This case report emphasises on the importance of CBCT and DOM in accurate diagnosis and management of a three rooted maxillary second premolar with three canals in a North Indian patient.

**Key words:** maxillary second premolar, extra rooted premolar, radiculous. CBCT

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#### INTRODUCTION

A thorough understanding of the root canal morphology as well as accurate diagnosis and interpretation of preoperative radiographs are highly essential for successful root canal treatment. Unidentified or missed canals can lead to a failed endodontic treatment. So, clinicians must be aware of all types of variations that may exist in the root canal system of various teeth.<sup>[1]</sup>

Maxillary second premolars are among the troublesome teeth to be treated endodontically because of various variables like the number of roots, the number of root canals, the course of the roots and different pulp cavity configuration. It is the only tooth that can show all the eight configurations of the Vertucci classification.<sup>[2]</sup>

A recent worldwide meta-analysis showed the overall prevalence of multiple canal morphology in the first premolar to be 93.5%, while in the second premolar, it was 49.7%. The prevalence of three roots was found to be 1.8% and 0.4% in maxillary first and second

premolars respectively. Asian countries typically exhibit lower number of root and root canals, whereas European and African populations tend to display higher proportions of these anatomical characteristics. A prevalence of 0.0% was reported in Indian population for three rooted maxillary second premolars.<sup>[3]</sup>

This case report presents a rare morphological variation of a maxillary second premolar with three roots and three canals which was treated endodontically at a teaching hospital in Jaipur, Rajasthan, India.

#### CASE REPORT

A male patient aged around 33 years, reported to the Department of Conservative Dentistry and Endodontics, RUHS College of Dental Sciences, Jaipur, Rajasthan, India with the chief complaint of spontaneous pain in the right upper back tooth region. The pain was continuous for the past one week and

was aggravated on chewing. The patient's medical history was noncontributory.

Clinical examination revealed a deep carious lesion in right maxillary second premolar. The tooth was tender to percussion. No abnormality detected on adjoining soft tissue examination. No periodontal pocket or mobility was present. Cold test (Endo-Frost, Coltene, Switzerland) and electric pulpal testing showed no response suggesting an irreversible damage to the pulp tissue.

The preoperative intraoral periapical radiographs revealed the presence of a 3 rooted maxillary second premolar with distinct mesiobuccal, distobuccal and palatal roots. The carious lesion was extensive involving the pulp space. Periapical rarefaction was noted in the palatal root [Fig. 1A]. On the basis of clinical and radiographic findings, the case was diagnosed as symptomatic irreversible pulpitis associated with symptomatic apical periodontitis.

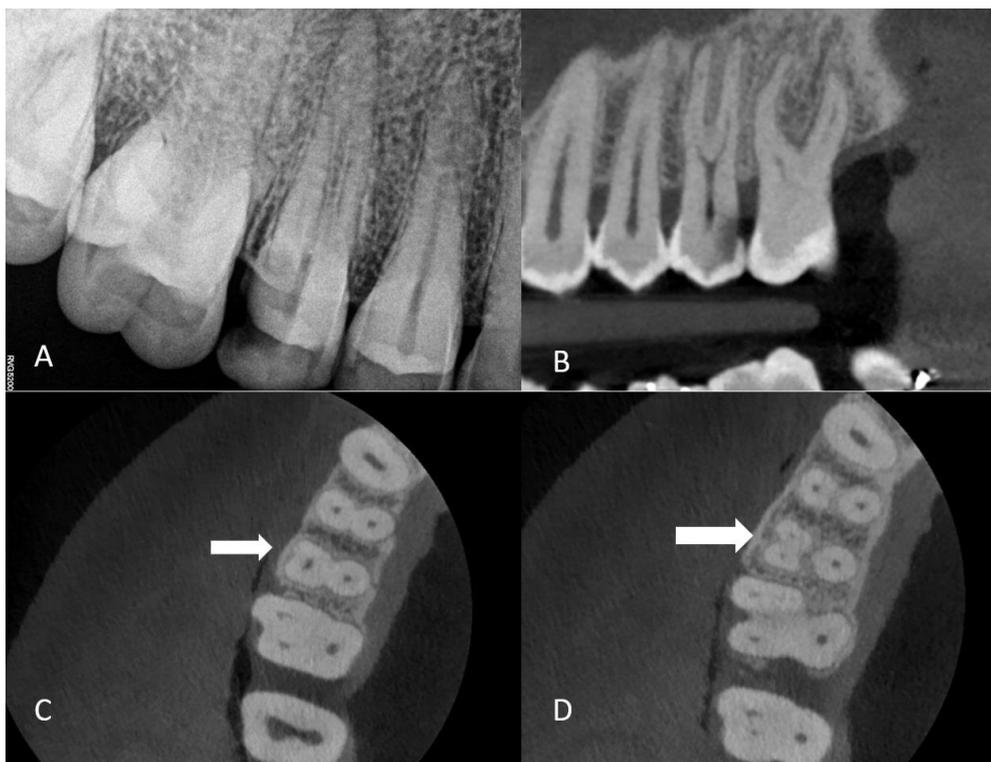
A preoperative CBCT was advised to confirm the unusual anatomy and canal configuration of the carious premolar. A Carestream CS9600 scanner was used to obtain CBCT images. Sagittal section showed the buccal root bifurcating into distinct mesiobuccal and distobuccal roots. [Fig. 1B] The axial sections showed three separate mesiobuccal, distobuccal and palatal roots. [Fig. 1C and 1D] Thus, CBCT confirmed the existence of three individual roots and root canals in the right maxillary second premolar.

After thorough clinical and radiographic evaluation, a nonsurgical endodontic treatment plan was decided for tooth #15. Informed consent was obtained from the patient. Local anaesthesia was administered using 2% Lignocaine containing 1:80,000 epinephrine (Xicaine, ICPA Health Products Ltd, Gujarat, India). Endo Access Bur (Dentsply Sirona, UK) was used to prepare the access cavity after rubber dam isolation. On clinical evaluation of the pulp chamber, two canal orifices were identified using an endodontic explorer (DG16) [Fig. 2A]. The orifices were cleared and flared using ultrasonic tips under magnification (25x)

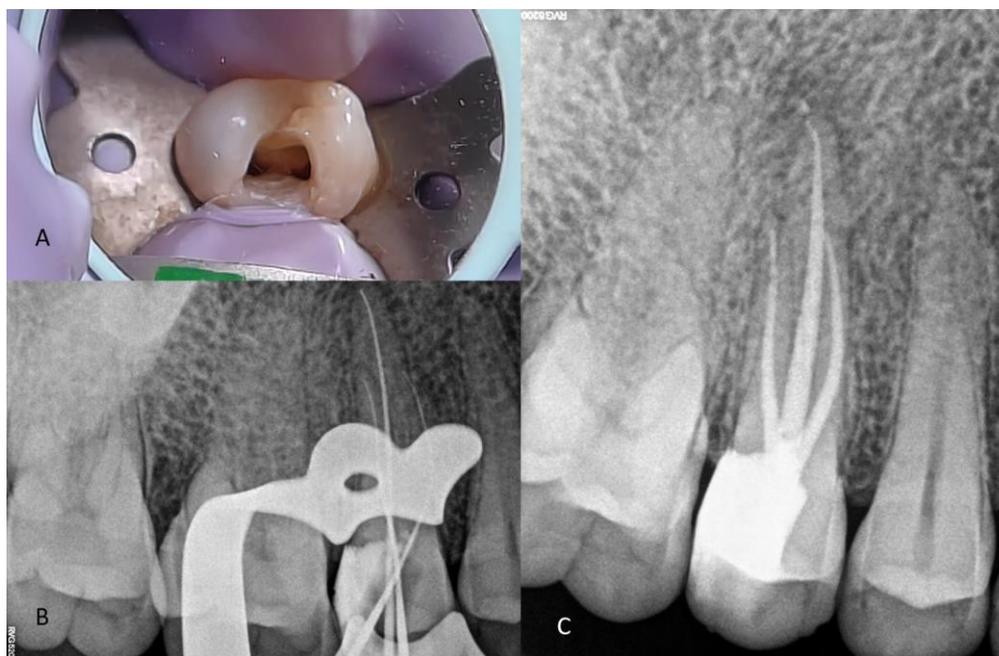
with a Leica M320 dental microscope (Leica Microsystems, Wetzlar, Germany). On careful exploration of the pulp chamber, the buccal orifice led to the mesiobuccal and distobuccal canals whereas the palatal orifice continued as the palatal canal.

The working length was determined using a Root ZX II apex locator (J Morita Corp.), and was confirmed by radiography [Fig. 2B]. A glide path was established carefully using size 10 K files (Dentsply Maillefer, Ballaigues, Switzerland). The root canals were subsequently cleaned and shaped using the NiTi HyFlex CM files (Coltene, Switzerland) to a size of 25, 0.04 taper in mesiobuccal and distobuccal canals. The wider palatal canal was prepared to a size of 30, 0.06 taper. One ml of 2.5% sodium hypochlorite (NaOCl) (Prime Dental Pvt Ltd, Maharashtra, India) was used per canal after every instrument change to irrigate the canals. Endoactivator tips (Dentsply Sirona, UK) of appropriate sizes were selected such that they fit loosely within 2 mm of working length. The tips were activated 2 mm short of apex and were used in a pumping motion for 1 minute. Any remnants of NaOCl were flushed out using normal saline, following which 17% EDTA (Prevest Denpro, Jammu, India) was used for removing the smear layer. Irrigation was done using a 30-gauge open-ended needle. The needle was kept 2 mm short of the working length to prevent binding in the canal. Irrigants were then activated by an Endoactivator.

The canals were dried with paper points. Fit of the gutta percha cones was checked in all the three canals using apical tug back method. A thin coat of AH Plus sealer (Dentsply Sirona, UK) was applied on the canal walls using lentulo spirals. Gutta percha cones were coated with the sealer and obturation was done using a single-cone technique. The access cavity was restored with composite resin and occlusion was checked. Finally, quality of obturation was checked using a radiograph. [Fig 2C].



**Fig 1. A. Preoperative radiograph of right maxillary second premolar B. Sagittal view of CBCT showing mesiobuccal and distobuccal roots in tooth #15. C and D. Axial views of CBCT showing division of buccal root into mesiobuccal and distobuccal roots in tooth #15.**



**Fig 2. A. Pulp chamber showing two distinct buccal and palatal orifices. B Working length estimation using radiograph. C. Tooth #15 post obturation and composite restoration.**

### DISCUSSION

Complex root canal patterns and morphoanatomic variations can lead to iatrogenic errors while performing root canal treatment. Thus, comprehensive understanding of the root canal anatomy and accurate diagnostic radiographs are essential before initiating root canal therapy. In the present case, periapical

radiograph, which provides a two-dimensional image of a three-dimensional object, could not provide adequate diagnostic information. Thus, CBCT images were obtained and analysed before initiating the root canal treatment. CBCT imaging provides a 3-dimensional view of the teeth and supporting

structures and hence aids in better visualisation of root canal anatomy.

Maxillary premolars exhibit a wide range of internal root canal configuration which can vary based on the geographic location and ethnicity.<sup>[3]</sup> The possible anatomic configurations of maxillary premolars have been well documented in the literature. However, the reports of maxillary second premolars with three roots and three canals in Indian population are only a few and most of them are from the central or southern parts of India.<sup>[4-9]</sup> This type of maxillary premolars with three root canals, palatal, disto-buccal and mesio-buccal are very similar to the maxillary molars in appearance and are often termed as 'small molars' or 'radiculous'.<sup>[10]</sup>

Visualization of three-rooted maxillary premolar on the preoperative radiographs can often be difficult due to their lower incidence of occurrence. Whenever there is a possibility of different anatomies, additional periapical radiographs should be taken at mesial or distal horizontal angles.<sup>[11]</sup>

Careful interpretation of radiographs can reveal external and internal anatomic details that can further suggest the presence of extra roots or canals. Sudden disappearance or even narrowing of a pulp space usually points out towards the presence of an extra canal. Sieraskiet al.<sup>[12]</sup> described the occurrence of maxillary premolars with three roots on a straight-on radiograph. According to him, the width of the mid-root image of three rooted premolars was equal to or greater than the mesiodistal width of their crown.

Additionally, when a radiograph shows an intracanal instrument in an eccentric position within the roots, multiple canals can be expected. Also, inspection of radiographs of contralateral teeth can provide valuable insights for comparing and identifying a complex root configuration when it is suspected.<sup>[12]</sup> In the present case, the contralateral tooth showed a single root architecture.

Despite the above-mentioned approaches, traditional radiographs have limitations due to the potential superimposition of structures and image distortion. For this reason, CBCT has emerged as a valuable tool in endodontics, offering three-dimensional visualization of the root canal system and surrounding tissues. It plays a crucial role in assisting the identification of variant root canals, thereby improving the prognosis of endodontic treatments.<sup>[13]</sup>

Bellizzi et al.<sup>[14]</sup> divided the root morphology of maxillary second premolars into three groups: (1) three fused roots or fused buccal roots with a partially fused or separate palatal root; (2) fused buccal roots at the middle or apical third with a separate or partially fused palatal root; and (3) all three roots are separate at the cervical third. According to the above criteria, the present case could be categorized into Group 3.

Maxillary premolars usually show an oval shaped access cavity with the larger diameter in the bucco-palatal direction. More than one root canal usually occurs whenever the pulp chamber is too large

or appear triangular in shape. Though, in this case report, the access cavity was oval with only two distinct orifices. Mesio-buccal and disto-buccal root canals were located by inserting hand files in buccal orifice at different angulations.

A thorough understanding of the anatomy of both the pulp chamber and the root canal system is of vital importance while performing endodontic therapy. The use of magnification and additional lighting is recommended for successful management of complex root canal system. The use of DOM in the present case aided in localization of anatomical landmarks in the pulp chamber as well as helped in localising the orientation of mesio-buccal and disto-buccal canals from a common orifice.

Use of Hyflex CM files for biomechanical preparation and obturation with single cone technique using gutta percha and AH plus sealer provided satisfactory results in the present case.

## CONCLUSION

Recent advances in endodontics have facilitated root canal therapy and improved the quality of treatment. The Clinician must ensure proper identification, preparation and obturation of all the canals by utilising all the means available. The success of nonsurgical endodontic procedures is greatly influenced by negotiating the highly variable anatomic structures as seen in the present case of maxillary second premolar.

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