

Endodontic Management of Radiculous Premolar: Perplexing the Unseen with the Eyes of CBCT- A Case Report

*Amit Tripathi¹, Abhilasha Manker², and Yashoti Agnihotri³

*Corresponding Author E-mail: dr.amittripathi2chat@gmail.com

Contributors:

¹Assistant Professor, Department of Orthodontics and Dent facial Orthopedics, Sri Aurobindo College of Dentistry, SAIMS, Indore, India, ²Assistant Professor, Department of Pedodontics and Preventive Dentistry, Sri Aurobindo College of Dentistry, SAIMS, Indore, India, ³Department Of Pedodontics and Preventive Dentistry, , Sri Aurobindo College Of Dentistry, Indore, Madhya Pradesh, India.

Abstract

Knowledge of root canal anatomy is important for successful endodontic treatment in a tooth. Deviations in anatomical presentation may pose great challenge in treating such teeth. Maxillary first premolar signifies as a transitional tooth between single rooted and multi-rooted teeth and has been reported with such anatomical deflection. Presentation of three canals has been reported in the literature frequently although presence of three roots is a rare occurrence. The disparity is clinically detectable only on radiographic examination. Though conventional radiographs may keep the clinician oblivious to the issue, novel three-dimensional imaging systems may unfold the complete picture. The case report presents the case of a carious premolar with pulpal involvement diagnosed as Radiculous premolar with irreversible pulpitis and clinical management along with its radiographic evaluation.

Keywords: CBCT, Radiculous premolar, bifurcated canal.

INTRODUCTION

Root canal treatment is a common treatment in dental practice. The canal anatomy is variable for different teeth and same tooth may present wide range of anatomical variations in different individuals. It is thus essential to have a thorough knowledge of root canal anatomy for endodontic treatment, in order to attain efficient cleaning, shaping and biomechanical preparation of canals, and thus to increase the chances of clinical success.¹

The maxillary first premolar has been reported with presence of two conical roots, buccal and palatal, with an incidence of 56% and around 40-45% showing fusion at different levels.² apart from these variations in their anatomical presentation have been reported. Vertucci & Gegauff³ have reported 5-6% incidence of three separate root canals in maxillary first premolars, 0.5% having three canals in single root, 0.5% had two canals in one root and 0.5-6% showing three roots having one canal per root.^{1,3} Hence it is essential to evaluate and diagnose a case using pre-operative diagnostic aids.

Radiographic interpretation is an important aid that plays a vital role in diagnosis and endodontic treatment planning of teeth with such complicated anatomy. Traditional radiographic techniques however, are based on two-dimensional projection and are baffled by numerous factors like adjacent anatomical structures and superimposition of surrounding dento-alveolar structures. On the contrary three dimensional imaging techniques claim a clearer vision in multiple planes with minimum distortion, giving a better understanding of root canal anatomy at various cross-sections.⁴

Studies have suggested that abrupt straightening or loss of continuity of radiolucent canal in radicular area of tooth when viewed on two dimensional radiograph should suggest an accessory canal.⁵ Also it has been suggested that an equal or higher ratio between mesio-distal width of mid-root and mesio-distal width of crown is most likely suggestive of presence of extra root.⁶ However these were assessed on periapical radiographs providing partial view of actual structure. Thus the present case justifies the importance and use of three dimensional

radiographic techniques like Cone Beam Computed Tomography (CBCT) as an adjunct in diagnosis and treatment of Radiculous premolar.

CASE REPORT:

A 13 year old male reported to the department of Pedodontics and preventive dentistry with moderate, dull aching, gnawing pain in upper right back tooth region since 3-4 days. Patient reported a history of night pain as well as radiation of pain to right eye and temple area. The medical history and family history were non-significant. On clinical examination an extensive carious lesion on disto-proximal surface of maxillary first premolar in first quadrant (#14) was seen. The lesion showed extensive involvement of enamel and dentin with loss of distal marginal ridge (code-06 of ICDAS-II). A pre-operative intraoral per apical radiograph (RVG) suggested absence of any per radicular pathology or periodontal space widening suggestive of acute irreversible pulpitis with #14 (Figure 1).



Figure 1: Pre-operative digital radiograph showing disto-proximal caries with #14

An endodontic treatment followed by full coverage crown was elected, keeping in mind the necessity to have a conservative approach. The root canal therapy was initiated under local anesthesia (2mL of 2% lidocaine hydrochloride with 1:80,000 epinephrine) and rubber dam

isolation. An access opening was done using end access bur #2 (DENTSPLY, Mallifer), following the ovoid outline of pulp chamber. A sterile spoon excavator was used to remove the coronal pulp tissue along with intermittent irrigation with normal saline, distill water and 3% sodium hypochlorite solution (NaOCl).⁷ The per apical radiograph suggested presence of two roots, buccal and palatal with two canal system ending with two different apical foramen. Therefore, both the canal orifices were explored using DG16 probe (DENTSPLY, Mallifer). The canals were then negotiated using #15 K-file (DENTSPLY, Mallifer). While working through the canal to the working length it was observed that the file tended to deviate from its designated path at some instances. This however, suggested the possibility of presence of unconventional canal anatomy. Thus a CBCT scan was advised to the patient to reveal a detailed anatomy of the root canal system. The CBCT revealed bifurcation of the buccal root at the level of middle third and 2.5 mm below the pulpal floor, into mesiobuccal and distobuccal roots (Figure. 2).

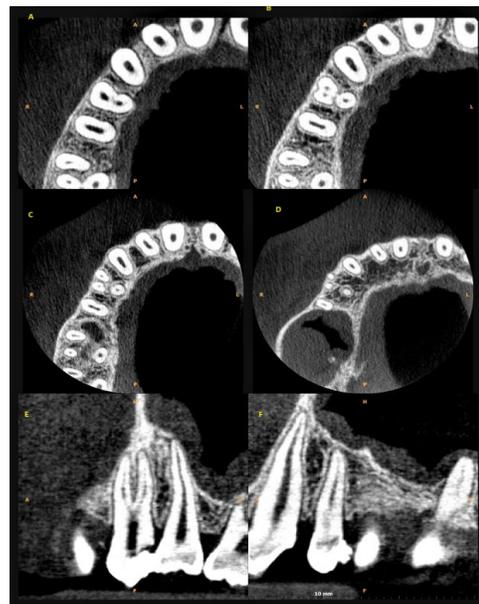
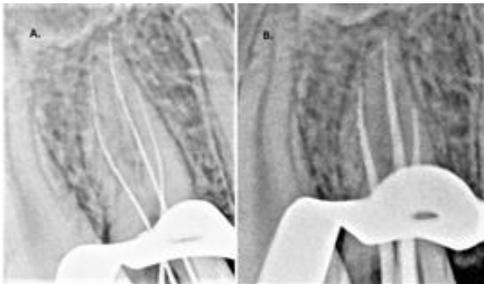


Figure 2: CBCT scan of #14; A) two canal orifices buccal and palatal at cervical third; B) bifurcation of buccal root at middle third; C) & D) three roots ending in separate apical foramina; E) & F) buccal view showing buccal and palatal roots.

The endodontic access opening was modified to a triangular outline for straight line access and the third canal, i.e., distobuccal canal was then negotiated using #15 K- file. Coronal flaring was carried out using Gates Glidden Drill no 1-3 followed by biomechanical preparation with shaping files Sx, S1, S2 and finishing file F1 (Protaper Universal, DENTSPLY, Mallifer, Switzerland) along with intermittent intracanal irrigation with 3% NaOCl, 17% EDTA and normal saline. An intracanal medicament (Calcium hydroxide with chlorhexidine vehicle) and closed dressing with Cavit G (3M ESPE) was placed and patient was recalled after 7 days.

On second-visit, the tooth was asymptomatic. Thus, removal of intracanal medicament followed by obturation was done using single gutta percha cone (F1) and Zinc Oxide Eugenol sealer and thereafter a post-endodontic restoration was placed (Figure 3). On a recall after one month the patient showed no signs of clinical or radiological concern with the corresponding tooth (Figure 4).



**Figure 3: A) Working Length determination;
B) Obturation of #14**



Figure 4: Post-operative radiograph on one month follow-up

DISCUSSION:

Several studies have suggested the impact of missed or untreated canals due to variation in anatomy, on clinical outcome of the endodontic treatment.⁸ Hoen & Pink⁹ stated that 42% of endodontic failures were attributed to missed canal. While the occurrence of three root canals in premolars is a rare instance, spotting such deviations and modifying the approach for biomechanical preparation is essential for clinical success. Maxillary first premolars with single root are a common finding among Asians (61.9%) while three-rooted premolars are reported to be extremely rare (0.6%)¹.

Though conventional radiographs are the mainstay for endodontic treatment as they are feasible, less time-consuming and more convenient, modern-day techniques in the field of medicine have found their utility in dentistry in various ways.¹⁰ Use of tuned aperture computed tomography (TACT), Digital Subtraction Radiography (DSR), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) in dentistry have been explored widely¹¹.

However CBCT has effectively overcome the drawbacks of the modern-day technologies and the limitations of conventional radiographs while providing access to the fine details of root canal anatomy. Math erne et al¹³ found that, clinicians failed to identify at least one root canal in 40% of teeth on digital radiographs, even with parallax radiographs. Thus, suggesting effectiveness of CBCT in root canal detection as compared to digital radiographs.

In the present case also, conclusions drawn from digital radiographs were insufficient to give a clear picture of the root canal anatomy. As a result CBCT was suggested for determining the actual configuration of root canal. The anatomy evident on the scan was classified as: Vertucci's type VIII and 3142-3 MB1DB1P1 according to classification system proposed by Ahmed et al.¹² The classification showed number of roots (n) tooth notation (TN) and thereafter each root with respective canal configuration in superscript defining the course of canal system from orifice (O) through canal (C) to the foramina (F), represented as – nTNO-C R1C-F R2C-F R3C-F.

The superscript on right side of TN represents bifurcation of canal system if below the pulp chamber¹³. In the above case the maxillary premolar showed three roots with the buccal root bifurcating in to two roots at the middle third and one canal per root, i.e., mesiobuccal, distobuccal and palatal.

CONCLUSION

Variation in anatomy must always be considered while planning endodontic treatment, as early detection of aberrant root canal morphology helps in preventing possible mishaps. This case report is yet another portrayal of such variation and suggests use of three dimensional imaging techniques as an essential aid in simplifying and clarifying the confusion. However, the importance of conventional radiographs cannot be overlooked for their ease of handling and feasibility, CBCT may be considered when information obtained through conventional radiographs is inadequate. The benefits modern-day radiographic techniques must be weighed against the cost effectiveness and radiation exposure should be objectively considered¹⁴.

ACKNOWLEDGMENT

Our sincere gratitude to Dr. Sadanand Kulkarni for his constant support throughout the case.

REFERENCES

1. Praveen R, Thakur S, Kirthiga M, Shankar S, Nair VS, Manghani P. The radicular premolars: case reports of a maxillary and mandibular premolar with three canals. *J Nat Sci Biol Med.* 2015 Jul; 6(2):442.
2. Relvas JB, de Carvalho FM, Marques AA, Sponchiado EC, Garcia LD. Endodontic treatment of maxillary premolar with three root canals using optical microscope and NiTi rotatory files system. *Case Rep Dent.* 2013; 2013.
3. Vertucci FJ, Gegauff A. Root canal morphology of the maxillary first premolar. *J Am Dent Assoc.* 1979 Aug; 99(2):194-8.
4. Karunakaran JV, Ganeshamoorthy T, Anbarasi K, Ragavendran N, Karthick AK. Maxillary permanent first premolars with

three canals: Incidence analysis using cone beam computerized tomographic techniques. *J Pharm Bioallied Sci.* 2019 May; 11(Suppl 2):S474.

5. Abraham D, Kumar PR. Radicular premolar. *Endodontology.* 2011; 23:95-7.
6. Sieraski SM, Taylor GN, Kohn RA. Identification and endodontic management of three-canal maxillary premolars. *J Endod.* 1989 Jan 1; 15(1):29-32.
7. Zehnder M. Root canal irrigants. *J Endod.* 2006 May 1; 32(5):389-98.
8. Tabassum S, Khan FR. Failure of endodontic treatment: The usual suspects. *Eur J Dent.* 2016 Jan; 10(01):144-7.
9. Hoen MM, Pink FE. Contemporary endodontic retreatments: an analysis based on clinical treatment findings. *J Endod.* 2002 Dec; 28(12):834-6.
10. Nair R, Kartha SR. Permanent Maxillary Premolars with Three Canals-A Case Report. *Int J Sci Res (Ahmedabad).* 2019 Nov; 8(11).
11. Durack C, Patel S. Cone beam computed tomography in endodontics. *Braz Dent J.* 2012; 23(3):179-91.
12. Matherne RP, Angelopoulos C, Kulild JC, Tira D. Use of cone-beam computed tomography to identify root canal systems in vitro. *J Endod.* 2008 Jan 1; 34(1):87-9.
13. Ahmed HM, Neelakantan P, Dummer PM. A new system for classifying accessory canal morphology. *Int Endod J.* 2018 Feb; 51(2):164-76.
14. Abella F, Teixidó LM, Patel S, Sosa F, Duran-Sindreu F, Roig M. Cone-beam computed tomography analysis of the root canal morphology of maxillary first and second premolars in a Spanish population. *J Endod.* 2015 Aug 1; 41(8):1241-7.