

Endodontic management of maxillary premolars with aberrant root canal morphology - a case series

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Abstract

A major cause of endodontic treatment failure is missed (or) untreated root canals. An accurate diagnosis of the morphology of the root canal system is a prerequisite for successful root canal treatment. Clinicians should be aware of anatomical variations in premolars and be able to apply this knowledge in radiographic and clinical interpretation. The occurrence of three canals with separate foramina in both the first and second premolar especially in the maxillary second premolar is shown to be in extremely low percentages and has been documented as practically non-existent in Asian populations. This article describes two cases of maxillary first and one case of maxillary second premolar with three roots and three canals.

Keywords: Abnormal morphology, premolars, root canal morphology, endodontic failure, root canal therapy

Introduction

The anatomy of the root canal system determines the parameters under which the endodontic treatment will be accomplished and directly affects the therapy success. Premolars have great variability in their internal morphology. Maxillary first premolars have reported an incidence of three canals from 0.5% to 6%.^{1,2,3} Carns and Skidmore⁴ found 6 of 100 maxillary first premolars to have three canals, all of which existed as one canal in each of three roots. In case of second maxillary premolars studies have demonstrated lower incidence of three root canals between .3- 2 %.⁵ Vertucci et al⁶ found 2 of 200 maxillary second premolars to contain three canals the incidence of which is extremely low. It has been studied

and analyzed that the presence or absence of a third root canal is influenced by genetic factors and that three rooted premolars are more frequent in Caucasian populations and virtually non-existent in Asian populations.^{7,8}

This case series presents diagnosis and endodontic management of three-rooted and three-canal maxillary first and three rooted and three canal maxillary second premolar which is very rare clinical entity.

Case 1: Endodontic management of three rooted and three canal maxillary first premolar

A 24 year old male patient with a non-contributory medical history reported to department of Operative Dentistry and

Endodontics, AMU, Aligarh with a history of spontaneous pain in maxillary right first premolar. A preoperative periapical radiograph revealing a carious lesion in maxillary right first premolar (Figure 1a). Clinically the pulp was exposed and electric pulp test response indicated irreversible pulp damage in the same tooth. There was an abrupt loss in radiolucency in the pulp cavity and externally in the middle-third of the root a great mesio-distal width associated with complex root morphology was observed. The periapical region appeared radiographically normal. Local anesthesia was induced with 2% lidocaine containing 1:80,000 epinephrine (Lignox 2% A, Indoco Remedies, Goa, India). A rubber dam was applied and coronal access was made with Endo Access bur and Endo-Z bur (Dentsply Tulsa Dental, OK, USA). Upon visual inspection with a surgical loupe (Neitz BLS-3, Tokyo, Japan), a dark line was observed between the buccal orifice and the distobuccal corner of the pulp chamber floor. In this corner, overlying dentin was removed using a diamond bur with a noncutting tip (Diamendo, Dentsply Maillefer, Surrey, UK) and a

second buccal canal orifice was detected. Access cavity was modified to "T" shape. Two buccal canals and one palatal canal were found. The root canals were explored with a K-file #15 (Dentsply Maillefer, Ballaigues, Switzerland). The radiographic length measurement was performed with the Rinn set (Dentsply Rinn, Elgin, IL, USA) and confirmed with an electronic apex locator (Raypex 5, VDW GmbH, Munchen, Germany) (Figure 1b). The root canals were shaped with protaper rotary instruments (Dentsply Tulsa Dental, OK, USA) up to the protaper F2. During preparation, EDTA (Glyde File Prep, Dentsply Maillefer, North America) was used as lubricant and the root canals were disinfected with sodium hypochlorite solution (2.5%). Canals were dried with paper points and then obturated with protaper gutta-percha F2 and AH Plus sealer (Dentsply Maillefer, North America). The pulp chamber was sealed with KetacFil glass ionomer cement (ESPE, Seefeld, Germany) and the tooth was restored with full crown. After ten months follow up, the tooth was completely asymptomatic with normal functioning (Figure 1c).

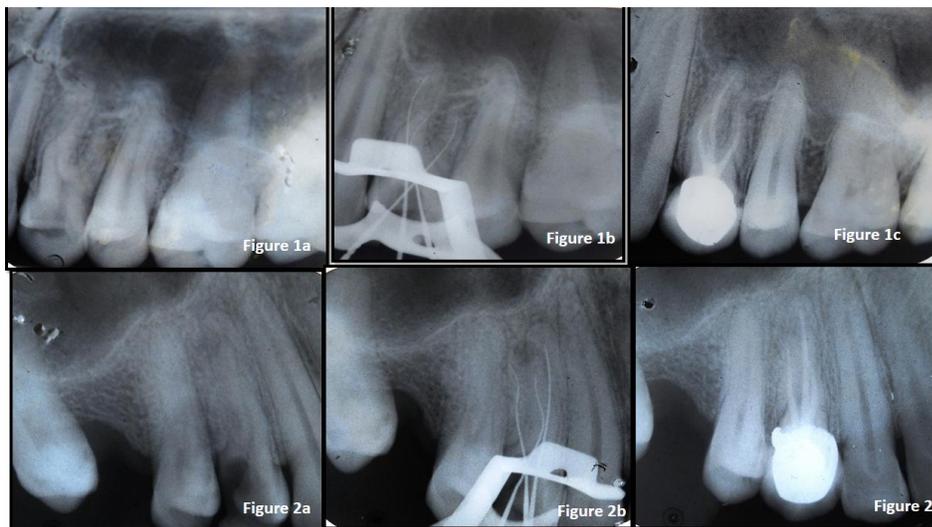


Figure 1a: preoperative periapical radiograph; **Figure 1b:** working length radiograph; **Figure 1c:** post obturation radiograph; **Figure 1d:** follow up radiograph; **Figure 2a:** preoperative periapical radiograph; **Figure 2b:** working length radiograph; **Figure 2c:** post obturation radiograph.

Case 2: Endodontic management of three rooted and three canalled maxillary first premolar

A 32 year old male patient with a non-contributory medical history was referred by oral diagnosis department for endodontic treatment of upper left first premolar. He had a history of spontaneous pain. Clinically the pulp was exposed by carious lesion.(Figure 2a).The tooth was isolated and access cavity was modified with a cut at the bucco-proximal angle from the entrance of the buccal canals to the cavo-surface angle resulting in a cavity with a T-shaped outline .After removing the coronal part, the buccal canals were explored with size 10 K file and the palatal with a size 15 K file resulting in clinical and radiographic confirmation of three canals suggested by the initial radiographic exam. The working lengths were estimated using an apex locator and then confirmed with a radiograph (Figure 2b). The root canal system was prepared with protaper hand files with copious irrigation using 2.5% sodium hypochloride solution. The canals were dried with paper points and obturated by protaperguttapercha and AH 26 root canal sealer. The treatment was completed and tooth was restored with metal ceramic crown.Patient was completely asymptomatic on follow up visit after twelve months (Figure 2c).

Case 3: Endodontic management of three rooted and three canalled maxillary second premolar

A 16 year old male patient with a non-contributory medical history was referred by oral diagnosis department for endodontic treatment of upper left second premolar. He had a history of spontaneous pain. Clinically the pulp was exposed by carious lesion. No swelling or fistula was present. There was some evidence of periapical radiolucency (Figure 3a). The tooth was isolated and access cavity was made. After removing the coronal part, the buccal canals were explored with size 10 K file and the palatal with a size 15 K file resulting in clinical and radiographic confirmation of three canals suggested by the initial radiographic exam. The working lengths were estimated using an apex locator and then confirmed with a radiograph (Figure 3b). The root canal system was prepared with protaper rotary files with copious irrigation using 2.5% sodium hypochloride solution. The canals were dried with paper points and obturated by protaperguttapercha and AH 26 root canal sealer (Figure 3c). The treatment was completed and the patient was completely asymptomatic on follow up visits.

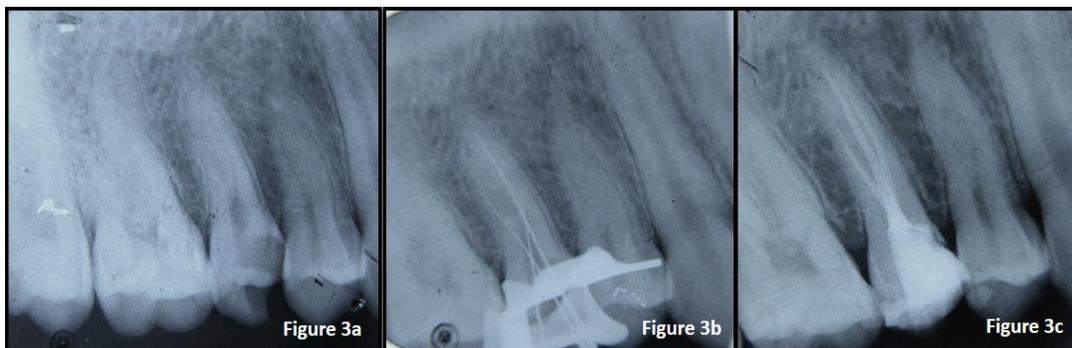


Figure 3a: Preoperative Periapical Radiograph; **Figure 3b:** Working Length Radiograph; **Figure 3c:** Post Obturation Radiograph

Discussion

An awareness of root canal morphology and careful interpretation of preoperative radiographs is necessary for success in endodontic therapy. Proper radiographic interpretation reveals internal and external anatomic details that suggests the presence of extra roots and canals

The root morphology of premolars can be highly complex and extra root(s) and canals can be found. The presence of a third canal in the maxillary both maxillary premolars is reported to be less [Table 1] [8,4,9,3,10] and especially rarely reported in maxillary second premolars [Table 2][6,11,5,12,13,14] Guidelines like “fast break” (Sudden narrowing or a disappearing pulp space) should be taken into consideration while assessing the pre-operative radiographs. If the root canal abruptly seems to straighten or broaden or if the course cannot be traced the presence of a second canal in the same

root or of a canal in another root superimposed on the first one because of the radiographic projection should be suspected and anticipated.¹⁵ The use of cone beam computed tomography is also recommended to identify unusual anatomy.¹⁶ In this particular case, the authors decided against its use due to the patient's unwillingness to undergo the procedure due to radiation concerns and cost.

Conclusion

Sound knowledge of the basic root canal anatomy and its possible variations, along with critical interpretation of radiographs, are essential elements for successful case management with teeth with unusual root canal morphology.

Conflict of interest: None

Source of support: Nil

Table 1: Percentage of number of root canals of maxillary first premolar as reported in various studies.

Author	Year	No of teeth Studied	One canal at apex (%)	Two canal at apex (%)	Three canal at apex (%)
Hess ⁸	1925	269	19.5	79.3	1.2
Carns and skidmore ⁴	1973	100	9	85	6
Pikora et al ⁹	1991	240	17.1	80.4	2.5
Kartal et al ³	1998	300	8.7	89.7	1.6
Lipski et al ¹⁰	2003	142	2.1	88.6	9.2

Table 2: Percentage of number of root canals of maxillary second premolar as reported in various studies.

Author	Year	No of teeth Studied	One canal at apex (%)	Two canal at apex (%)	Three canal at apex (%)
Vertucci ⁶	1974	200	75		1
Bellizzi and Hartwell ¹¹	1985	630	40.3		1.1
Pecora et al. ⁵	1992	300	67.3		.3
Kartalet al. ¹²	1997	300	55		.6
Khurramet al. ¹³	2005	57 females 43 males	47 37	53 63	0 0
Jayasimha Raju ¹⁴	2010	200	64.1	35.4	0

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