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CASE STUDY

ENDODONTIC MANAGEMENT OF RADICULOUS MAXILLARY FIRST PREMOLAR WITH THREE CANALS

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ABSTRACT

Successful endodontic treatment mandates knowledge of internal and external anatomy of teeth along with their deviations. Maxillary first premolars usually have definite pattern of roots and root canals but, deviation in the form of having extra root and root canal is rare. Proper clinical and radiographic evaluation, magnification and modified access cavity preparation helps in diagnosis and treatment of such anatomical variation. This case report describes identification, treatment modifications and successful endodontic management of three rooted and three canalled maxillary first premolar.

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INTRODUCTION

Knowledge of internal as well as external anatomy of teeth and careful interpretation of preoperative radiograph are essential to identify, clean and shape all root canals. In endodontics intraoral radiographs provide valuable information regarding number of roots and canals, root length, root and canal direction as well as curvature. But, due to their known limitation of providing two-dimensional (2D) images of a three-dimensional (3D) object; radiographs taken at multiple angulations are recommended (Fishel *et al*., 1978; Ingle *et al*., 1985). Premolars are the non-succedenous teeth to erupt in oral cavity and found to be commonly decayed after permanent molars. Maxillary first premolars usually have two distinct roots with two separate canals. Variations in the form of additional root or canal, fused roots and canals have been well documented in the literature. In mandibular molars when an additional distal root present lingually it is designated as Radix entomolaris whereas, an extra root present on buccal side it is called as Radix paramolaris. Vertucci *et al*. observed maxillary first premolars with three canals in 5-6% population and incidence of 1% in maxillary second premolars. They also found that out of 400 observed maxillary first premolars; 0.5% have single root with three canals, 0.5% have two canals in a root and one canal in the second root and 4% with three separate roots and canals (Vertucci *et al*. 1979b). Vertucci *et al*. also observed three root canals in 2 of 200 cases of maxillary second premolars (Vertucci *et al*., 1974a). In a similar study by Carns *et al*. it was evident that 6% of maxillary first premolars have three canals with three separate roots (Carns *et al*., 1973). Also, very few cases have been reported in literature describing cases of successful endodontic management of tree rooted i.e. radiculous maxillary premolar with three roots and three canals (Malibaum, 1989, Goon, 1993, Hacer *et al*., 2009).

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Case report

A 22 year old healthy male patient was reported to department of Conservative Dentistry and Endodontics, with a chief complaint of pain in upper right back tooth since 3 days. The pain was spontaneous. Clinical examination showed carious tooth #24 with pulp exposure. Intra Oral Periapical (IOPA) radiograph revealed caries involving pulp tooth #24 with diffuse periapical radiolucency (Figure 1). Interestingly an additional third root with single root canal was suspected in the radiograph. Electric pulp test showed no response confirming the diagnosis of pulp necrosis in tooth #24. After obtaining informed consent of the patient root canal treatment in tooth

#24 was advised. Local anesthesia was administered and the tooth #24 was isolated under rubber dam. Access cavity was prepared under 3.5X magnification loupe to explore additional canal. To locate third canal orifice access preparation was modified and extended toward disto-buccal aspect, making the T-shaped cavity outline (Ballizi *et al*., 1985). Access cavity was accomplished and the floor of the pulp chamber was examined which revealed two buccal and single palatal root canal orifices (Figure 2). Both the buccal canals were explored with No. 10 K file (Mani, Japan) and the palatal canal with No. 15 K file and working length radiographs with two angulations were made which confirmed three roots with three canals i.e radiculus premolar (Figure 3a,b). Working length was measured using Ingle's radiographic method and confirmed with an electronic apex locator as an adjunct (Root ZX, Morrita, Tokyo, Japan). The tooth #24 has working length of 17 mm confirmed single tooth true microdontia. After establishing glide path with file size 10 and 15, using crown down technique coronal flaring was done with Protaper Sx file. The root canals were prepared with size 20 K-files apically with continuous copious irrigation using 2.5% warm sodium hypochloride solution. The irrigating solution was agitated using Endo-activator agitation tip. Final apical preparation was done with Protaper F1 file (Dentsply, Maillefer) using continuous, copious irrigation of warm 3% sodium hypochlorite solution. Later root canals were irrigated with 17% EDTA (Ethylene diamine tetra acetic acid) solution followed by rinsing with saline. Calcium hydroxide intracanal medicament was applied and temporary restoration was placed in the tooth #24. The patient was recalled for next visit after two weeks.

Figure 1. Pre-operative IOPA of tooth #24, showing unusual root anatomy with diffuse periapical radiolucency

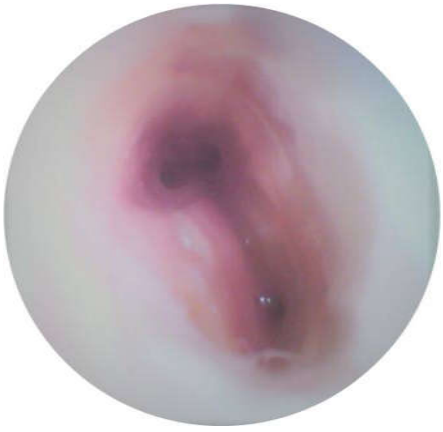

Figure 2. Intraoral photograph showing three distinct root canal orifices in tooth #24

Figure 3a. Working length straight –on angulation IOPA radiograph of tooth #24 showing three separate roots and canals

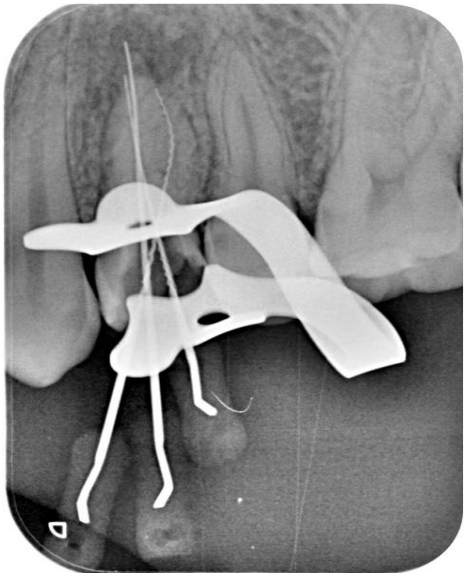

Figure 3b. Working length mesial angulation IOPA radiograph of tooth #24 showing three separate roots and canals

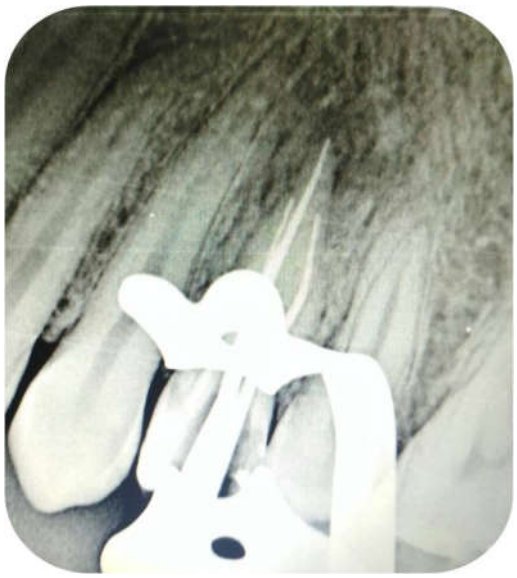

Figure 4. Master cone IOPA radiograph confirming proper apical fit and extension

Figure 5. IOPA radiograph of tooth #24 showing root canal obturation and extruded calcium hydroxide cement

Figure 6. Three months post operative radiograph showing reduction in periapical radiolucency and healing

In next visit when patient was asymptomatic, obturation was advised. All root canals were copiously irrigated and then dried with Protaper universal F1 absorbent paper points (Dentsply, Tulja Dental). IOPA radiograph was taken to check proper fit and extension of all gutta percha master cones (Figure 4). Using AH plus endodontic sealer (Dentsply, Detrey) with Protaper F1 gutta percha points obturation was done using warm vertical compaction technique. Post operative IOPA radiograph was advised after intermediate coronal restoration which showed root canal obturation and extrusion of calcium hydroxide cement through root apex (Figure 5). Patient was recalled for post endodontic permanent restoration after a week. After three months follow up, IOPA radiograph of tooth #24 showed satisfactory healing with reduction in periapical radiolucency (Figure 6). Patient was kept under observation and advised a full coverage restoration in tooth #24.

DISCUSSION

For successful endodontic treatment knowledge of tooth anatomy is a pre-requisite. Premolars being non–succedenous teeth are atypical in their anatomy. Mandibular premolars are known for their aberrant anatomy and known as Enigma to the Endodontist. Maxillary premolars usually showed less anatomic variation than mandibular premolars. Various anatomic variations such as extra root, extra canal and S-type curvature of root etc. in maxillary premolars have been well documented in the literature. To rule out extra root and root canal preoperative as well as intra-operative radiographs with different angulations are required. Advance imaging technique such as cone beam computed tomography also proved to be more informative in revealing internal and external anatomy of teeth (Slowely, 1974; Slowely, 1979, Javidi *et al*., 2008). Vertucci *et al*. have done extensive study on root canal configuration and observed that, maxillary first premolars and second premolars with three canals have incidence of 5-6% and 1% population respectively. They also found that out of 5% cases of these three canalled maxillary first premolars; 0.5% have single root with 3 canals (Vertucci Type VIII), 0.5% have two canals in a root and one canal in the second root (Vertucci Type IV and Type I) and 4% with 3 separate roots and canals. Vertucci *et al*. also observed 3 root canals in only1% of maxillary second premolars in 200 people (Vertucci *et al*., 1974a). In other study radiculous i.e. three rooted maxillary first premolars was evident in 6% cases (Carns *et al*., 1973).In a study involving examination of 150 extracted maxillary first premolar teeth from people of southern Spain, 60 teeth had one root (40.0%), 85 teeth had two roots (56.7%) and only five teeth presented with three roots (3.3%) (Chaparro *et al*., 1999). Mariusz *et al*. in another study found that 9.2% of first maxillary premolar has three canals (Mariusz *et al*., 2005). A study recently carried out in Asian population of Nepal, 58% had single root, 20% had two roots, 21% had fused roots and only 1% had three roots (Dashrath *et al*., 2015).

Maxillary first premolars usually have two roots and two canals, one buccal (B) and one palatal (P). Presence of an additional root or root canal may lead to enododontic failure when become undetected and uncleaned. When such teeth have periodontal involvement due to primary endodontic or periodontal origin, the management of such teeth at furcation region become complex due to inadequate and access to instrumentation and inability of patient for self-maintenance of involved area (Pradeep *et al*., 2015). To identify possibility of additional root or root canal, multi-angulated radiographs with good interpretation are necessary. When in a radiograph there is sudden disappearance of root canal, it usually indicates bifurcation of the canal and known as Fast break principle. These bifurcated canals exit as one from pulp chamber and may divide into two parts which may remain as separate or they merge just before reaching the apex having different canal configurations (Vertucci, 1978). In such cases of additional canal, the orifice location is usually found off centered and provides a clue to the operator about possibility of presence of extra canal.

To manage such atypical cases of endodontic variation, good illumination and magnification improves the treatment outcome. In maxillary first premolar when additional canal is present it often present as second buccal canal in distobuccal aspect and very closed to main buccal canal. The access cavity should be modified and the T-shaped opening of canal orifices has been observed as in our case. With the use of magnification devices such as loupes or dental operating microscope, it becomes easier to identify all canal orifices. Magnification in endodontics not only facilitates better vision, magnification and co-axial illumination but also gives ease of

preparation and obturation of root canals. It also provides less stress to eyes and improves ergonomics of operator and concomitantly prevents any procedural error.In presented case report, three canals were suspected from preoperative radiograph. As any missed canal would lead to ultimate endodontic failure, two radiographs at two different angulations were advised which confirmed the diagnosis of radiculous and three canalled tooth #24. Electronic apex locator also helps in correct working length determination when used as an adjunct with IOPA radiographs. To locate and prepare the additional canal the outline of the access cavity preparation was modified to T-shaped opening.

Conclusion

Anatomical variations should always be suspected before initiation of any endodontic procedure. Prompt and careful clinical and radiographic evaluations are necessary for identification of anatomical variation. Use of magnification in endodontics enhances the visualization of the pulp chamber, canal orifices and facilitates instrumentation in successful endodontic treatment.

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