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Endodontic management of three rooted premolars with atypical root canal morphology: Case report

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Abstract

Anatomical variations in the root canal morphology is a commonly occurring phenomenon. Arriving at a precise diagnosis clinically and radio-graphically would lead us to appropriate treatment planning which is mandatory for successful outcome of the endodontic treatment. Maxillary and mandibular second premolars have intricate root canal anatomy. The incidence of three rooted premolars is very rare in Indian population, presence of additional roots would make the clinician's job difficult and challenging. The following case report describes the endodontic and restorative management of maxillary and mandibular second premolar with atypical root canal anatomy being successfully treated with the help of magnification.

Keywords: Atypical root canal, premolars, magnification

Introduction

The outcome of Root Canal Treatment (RCT) greatly depends on thorough knowledge of the anatomy of the involved tooth. This would enable a clinician to locate, clean, shape and obturate the root canals three-dimensionally^[1]. However, anatomical variations are extremely complex to treat, posing a challenge^[2]. Proper technique must be exercised in locating and negotiating extra root canals^[3]. Missed canals or inadequate cleaning and shaping of these extra canals would lead to the failure of endodontic treatment^[4].

Since premolars have most anatomical variations, Vertucci classified root canal morphology of lower second premolars into eight different types^[5, 6]. According to a study conducted for Indian population, there was 35.4% incidence of maxillary second premolars showing 1:2 configuration with a single root canal dividing into two at the apex and the incidence of maxillary second premolars with three root canals is rare accounting to 0.3% to 2%^[8, 9]. The occurrence of three root canals in maxillary second premolars is more frequent in Caucasian population and virtually non-existent in Asian population^[10, 11].

According to an in-vitro study, the incidence of mandibular second premolar with single root and single canal is 97.5% and 1:2 configuration is 2.5%^[12], 1:3 configuration is 0.4%^[13].

This case report depicts management of two such premolars with aberrant root canal anatomy.

Case Report 1 – Maxillary Second Premolar

A 37-year-old male patient, reported with the chief complaint of pain in his upper left back tooth region since 2 weeks. On intraoral clinical examination, class II disto-proximal deep dentinal caries was noted with respect to upper left back tooth region. The tooth did not respond to cold test (endofrost spray- coltene) and electric pulp testing (EPT) and was tender to percussion. On radiographic examination, radiolucency involving enamel, dentin and extending to the pulp, widening of the periodontal ligament along with loss of lamina dura was observed and was diagnosed as pulpal necrosis with symptomatic apical periodontitis. Root canal was initiated and during working length determination it was observed that #15 k file was deviating slight distally at the apical third and on the mesial, an extra pulp canal space was noted radiographically.

For a better understanding of the root canal morphology, CBCT (Cone Beam Computed Tomography) was advised, which revealed that the buccal root was bifurcating into mesial and distal roots at 12.5 mm from the buccal cusp tip and single palatal root with single canal was noted. Access cavity preparation (Endo access bur-Dentsply) was refined under rubber dam isolation. Canal Orifices were enlarged and patency of all the canals was achieved using size #10 K files under magnification. Working length was determined using electronic apex locator and verified radiographically. The mesio-buccal and palatal canals were shaped using NiTi rotary instruments and were enlarged to size #25, 4 percent taper. The disto-buccal canal was shaped using endodontic hand files and was enlarged to size #40, 2 percent taper. Irrigation was done using 3% sodium hypochlorite followed by 17% EDTA using passive ultrasonic activation. Aqueous calcium hydroxide intracanal medicament was placed for a week. In the subsequent visit patient was asymptomatic, tooth was non tender and intracanal medicament was removed with hand files with copious saline irrigation and dried with absorbent points. 2% chlorhexidine gluconate was used as final rinse.

The mesio-buccal and the palatal canals were obturated using warm vertical compaction technique and the distobuccal canal was obturated using cold lateral compaction technique using gutta percha cones and Bio -C sealer. Access restoration was done using composite and full coverage porcelain fused metal (PFM) restoration was given as post endodontic restoration.



Fig 1: Pre-OP Radiograph – 25

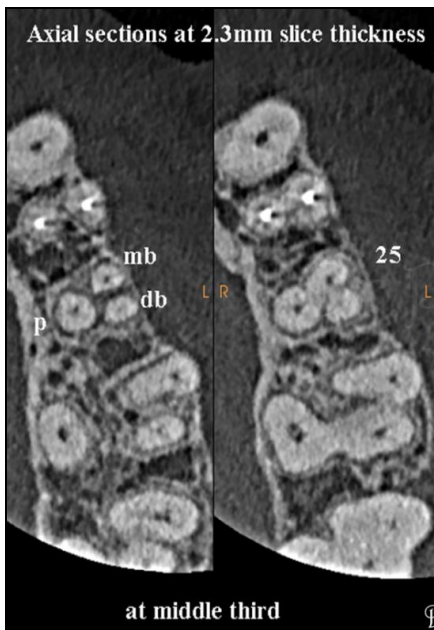


Fig 2: CBCT reveals 3 canals – mesio-buccal, distobuccal & palatal

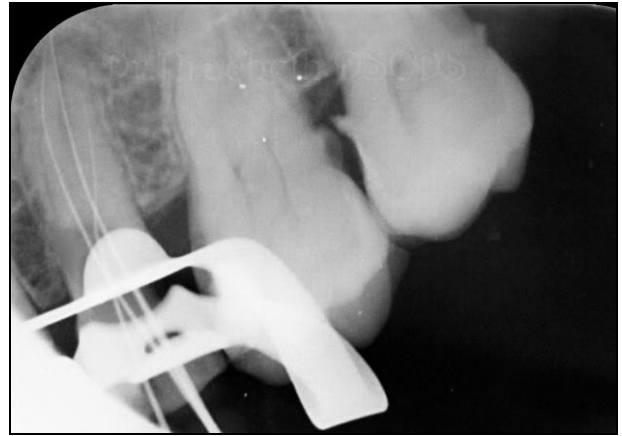


Fig 3: Working length determination



Fig 4: Master cone selection



Fig 5: Obturation of 25



Fig 6: Post endodontic restoration

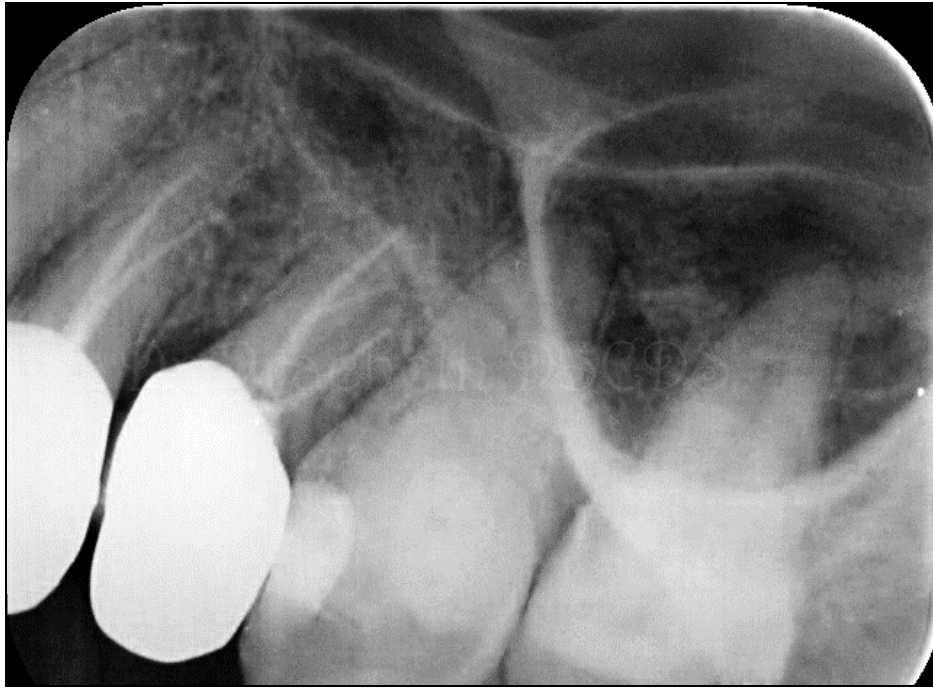


Fig 7: 6 months follow up

Case 2 – Mandibular Second Premolar

A 34-year-old male patient reported with chief complaint of pain in his lower right back tooth region since 1 month. On intraoral clinical examination, class II disto-proximal deep dentinal caries was noted in relation to 45. Delayed response to cold test and electric pulp test, radiolucency involving enamel, dentin extending to pulp was observed over the distal aspect, loss of lamina dura and widening of the periodontal ligament space was observed. Based on the clinical and radiographic evaluation, a diagnosis of symptomatic irreversible pulpitis and aberrant root canal morphology was noted. On CBCT evaluation, second premolar showed single root, trifurcating at the apical third of the root at 12.5 mm from the buccal cusp tip into mesiobuccal, distobuccal and lingual roots. Hence, according to CBCT 45 had 1-3 root canal configuration.

Access cavity preparation (Endo access bur – Dentsply) was done in relation to 45 under rubber dam isolation and operating microscope. Canal orifice was enlarged and patency was achieved using size #10 K files. Working length was determined using electronic apex locator and verified radiographically. Root canals were shaped using rotary NiTi instruments and were enlarged upto the size #25.04%. Irrigation was done with 3% sodium hypochlorite followed by 17% EDTA was carried out throughout the procedure with intermittent saline rinse. Passive ultrasonic activation was done and final rinse with chlorhexidine. Obturation of these canals were done using Bio – C sealer and warm vertical compaction technique till the root trifurcation. Since there was less than 50% of sound coronal tooth structure was present, fiber post was luted with self-adhesive resin cement. Root canal retreatment of 46 which lacked coronal restoration with periapical radiolucency was subsequently done. Single unit PFM crowns were fabricated for these teeth.



Fig 9: Pre-OP Radiograph of 45

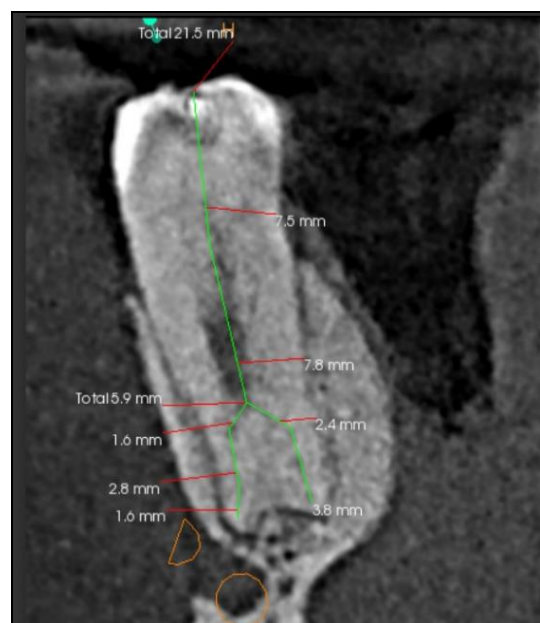


Fig 10: CBCT evaluation of 45

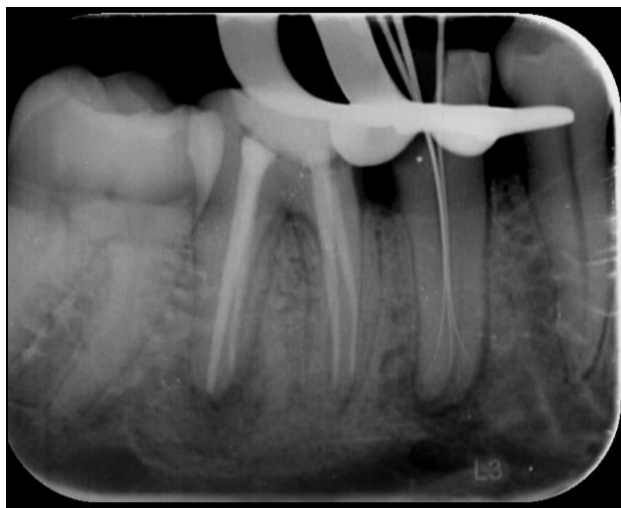


Fig 11: Working length determination



Fig 12: Master cone – Mesiobuccal canal

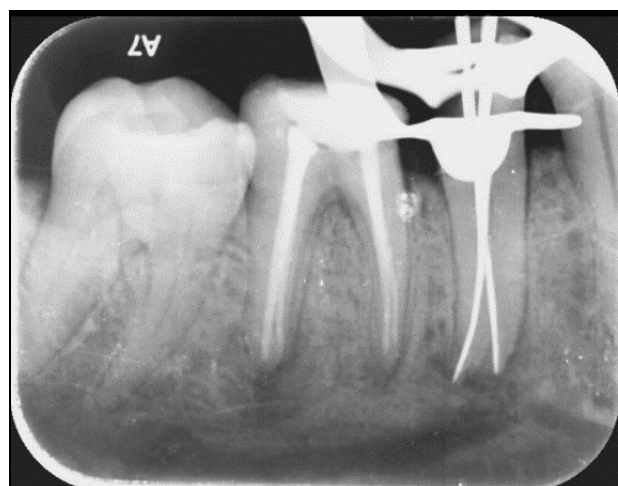


Fig 13: Master cone selection



Fig 14: Obturation of 45 Distobuccal & Lingual canals



Fig 15: Post endodontic restoration



Fig 16: 6 months follow up

Discussion

Endodontic treatment of maxillary and mandibular premolars remains a challenge because of the variation in root canal configuration [14, 15]. Missed root canal can lead to failure of the endodontic treatment.

Cone beam computed tomography (CBCT) is an exquisite diagnostic modality for three-dimensional view of the teeth with complex root canal anatomy. This will help in location of extra canals or missed canals [16]. 90 microns of resolution with exposure parameters of 90KV & 10 mA were the CBCT parameters were used in this case. According to the newer classification system given by Macro Versiani maxillary premolar with bifurcating buccal root can be represented by $25^B_{1-2-2}P^1$ [17]. The second case of mandibular second premolar showed single root bifurcating at the middle third into buccal and lingual roots and the buccal root further bifurcating into mesio-buccal and disto-buccal roots at the apical third categorized as vertucci type IX canal configuration.

Use of magnification in the form of surgical loupes and operating microscope can aid in better diagnosis, visualisation and management of root canal aberrations. CBCT evaluation can act as an adjunct for the same.

Endodontic treatment of mandibular second premolars is challenging because of its variation in the internal morphology, extra root canals, apical delta and lateral canals [18, 19]. During placement of scouting files (k file 8 and 10) obstruction was encountered as file was deflecting towards the lingual canal. Appropriate precurving of the files, tactile sense of the operator and repositioning of the subsequent files in the same direction helps one to negotiate, instrument these canal aberrations thoroughly. Anticurvature filling with the use of H files was done to prevent straightening or strip perforation of the inner curve of the root canals.

Still there can be areas which are left untouched by the endodontic instrument necessitating the use of better irrigants and techniques that can disinfect the root canal space.

Passive ultrasonic activation of the irrigants was done using ED15T (Woodpecker) was used.

Obturation of these atypical root canal systems is demanding, Warm vertical Sectional obturation technique with hot hand pluggers (size 2 – Dentsply) followed by back filling using system B for managing both the cases helped to obtain a three-dimensional seal. Use of Bio ceramic sealers provide an added advantage of better periapical tissue repair owing to antimicrobial property and alkalinity and calcium deposition. Hence bio ceramic sealer was used for obturation [20, 21].

Conclusion

Endodontic management of teeth with atypical root canal morphology is exigent to the clinician right from the diagnosis till post-endodontic restoration. Endodontic management of teeth aberrant root canal morphology as become a reality owing to better diagnosis with the use of CBCT, good visualization by magnification aids, newer rotary file system for proper canal shaping aided with newer irrigation and obturation techniques/devices. The overall prevalence of missed canals among endodontically treated teeth was 18% and apical periodontist in such cases were 90%. Hence, clinicians should be fully aware of tooth anatomy, root canal configurations, and possible variations before the start of root canal therapy procedures in order to minimize the possibility of missing canals during treatment.

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