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Beyond the Usual Four: Management of Six Canaled Maxillary Molars-Case Series

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Abstract: ***The endodontic treatment of maxillary molar with aberrant root canal morphology can be diagnostically and technically challenging. The probability of morphologic variations in a tooth should never be misconstrued and the cognition of these variations is the key to successful endodontic treatment. Along with properly designed access cavity, well-angulated radiographs, and routine use of loupes, the practitioner should consider using dental operating microscope and cone beam computed tomography as an auxiliary method for detecting complex root canal anatomy. Studies indicated that there was a low incidence (0.31%) of 775 CBCT images of maxillary first molars with six root canals; however, anatomic variation studies in the second maxillary molars were not numerous. This clinical case series presents the successful management of maxillary molars with six root canals using dental operating microscope.***

Keywords: Additional canals, Dental operating microscope, Maxillary molars, Root canal anatomy, Six canals

1. Introduction

In-depth knowledge of the structure of the root canal and its anatomic variations is an indispensable prerequisite to achieving successful clinical outcomes of NSRCT. Failure to detect or treat additional canals than normally encountered is the major reason for failed root canal treatment. Amongst all the permanent teeth, maxillary permanent molars have the maximum rate of NSRCT failure due to the associated complex structure and variations in the anatomy.[1]

The quality of root canal fillings is associated with ideal biomechanical instrumentation and followed by homogeneity obturation of the root canal structure. On the other hand, the type of roots and the morphology characteristics of mandibular molar teeth present clinical complications that often jeopardize the endodontic therapy. Therefore, clinicians must be able to identify the root canal structure before or during a root canal treatment.[1] It is known that the presence of additional canals or deviations of the main root canals can cause endodontic flare-ups and failures.[2]

Most studies in anatomical variations of maxillary molar teeth appear to deal with the first molar. There are references to teeth with four to six canals, and in the mesio-buccal and in the palatal roots, the number of canals can vary between one and three. There are also reports of two canals found in the disto-buccal root.[3] Anatomical variation studies in the second maxillary molars are not so numerous.[3]

Locating and then disinfecting these extra canals are challenging and depend on many factors.[4] It is possible that the use of an operating microscope or loupes to enhance the view of the operative field might increase the ability to locate the canal.[5]

Case 1

A 35 year old female patient was referred to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospital presented with the chief complaint of pain in the right upper back tooth region. The recently developed pain was spontaneous, continuous in nature, which aggravated on heat intake & change in a posture and required analgesics for relief. Patient also complained of pain at night. The patient's medical history was non-contributory. On clinically examining the patient, it was ascertained that the patient had deep occlusal caries in the right maxillary first molar. Tooth was moderately tender to percussion and palpation. Periodontal probing and mobility were within normal limits. The tooth did not respond to Electric Pulp Test (EPT). The tooth was diagnosed with symptomatic irreversible pulpitis with apical periodontitis and endodontic treatment was suggested to the patient.

Informed consent was taken. Root canal treatment was initiated on the same sitting by anesthetizing the offending tooth using 1.8 ml of 2% lignocaine comprising 1:200,000 epinephrine under rubber dam isolation. Caries was excavated using a number 2 round bur in a slow speed handpiece, following which the pulp chamber was deroofed.

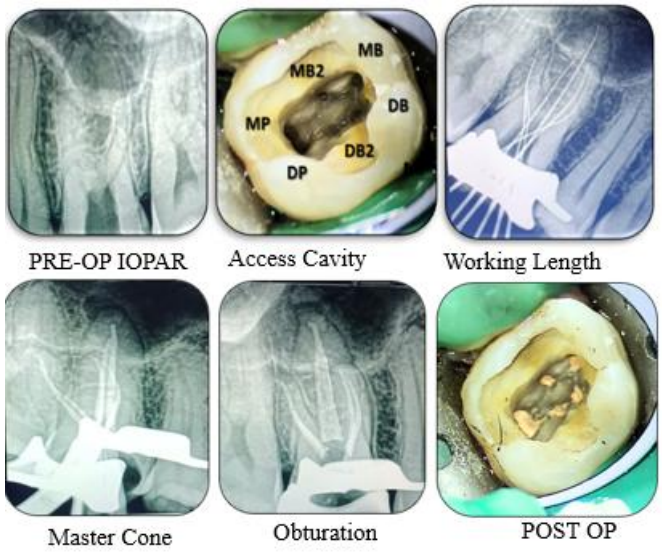
Endodontic access cavity was prepared using a round diamond and Endo-Z high-speed burs. Three principal root canal systems i.e. mesiobuccal (MB), distobuccal (DB), and palatal were located on clinical evaluation of the internal anatomy. After probing with a DG 16 endodontic explorer, small hemorrhagic points were noticed 2 mm palatal to the main MB canal and DB canals named MB2 and DB2 respectively. As the palatal canal orifice seemed off centered, so the dentin occluding the orifice of the palatal canal was carefully removed with the help of ultrasonics and a second palatal canal was identified. This was further evaluated and verified with Dental Operating Microscope. Two distinct orifices were seen in all the roots under the microscope.

The orifices were located under magnification using DG 16 explorer, Using K-flex files patency was maintained and working length was determined with help of an electronic apex locator. The initial hand filing till #20 was done in all the root canals. The working length in each root canal was confirmed radiographically.

Mesiobuccal root followed vertucci's type 4, distobuccal followed Vertucci's type 2 and Palatal canals followed Vertucci's type 2.

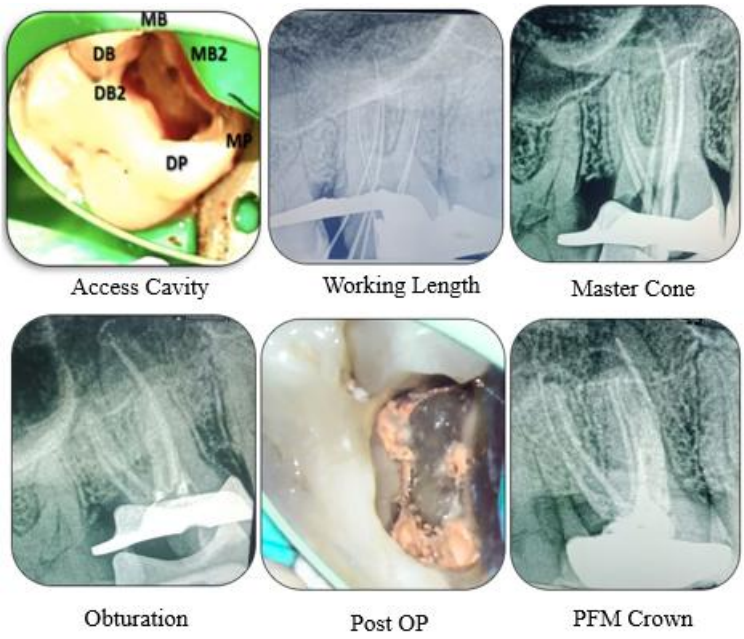
The root canals were then prepared with Neo Endo flex nickel-titanium rotary instruments with the master apical file size of 25.04 for MB (Mesiobuccal 1), MB2 (Mesiobuccal 2), DB1 (Distobuccal 1), DB2 (Distobuccal 2), and 25.06 for P1(Palatal 1), P2 (Palatal 2). Copious irrigation with sodium hypochlorite was done during the shaping and cleaning procedure of the canals followed by final irrigation with 17% EDTA. The root canals were then completely filled with calcium hydroxide and an intermediate restoration was placed.

The patient was recalled for further treatment after a week. Under rubber dam isolation, Cavit and calcium hydroxide were removed and the canals were irrigated with 2.5% NaOCl and 17% EDTA. The canals were dried with paper points followed by obturation of canals using single cone gutta-percha and a resin-based sealer. The tooth was then restored with a composite resin restoration and a full-coverage porcelain fused to metal crown was advised to the patient.



Case 2

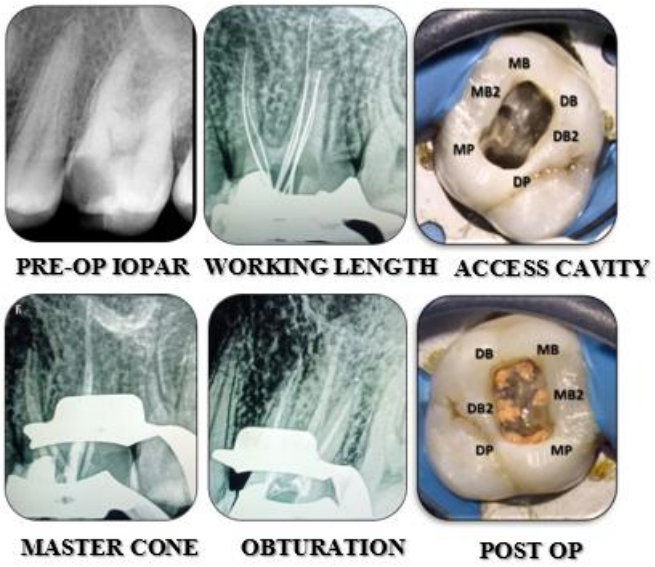
A 44 year old female patient was referred to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospital presented with the chief complaint of pain in the left upper back region. The recently developed pain was continuous and referred in nature, which aggravated on heat intake and required analgesics for relief. Patient also complained of pain at night. The patient's medical history was non-contributory. Clinical examination revealed a tooth with a large mesial proximal carious lesion with respect to tooth no. 27, which exhibited percussion sensitivity. Periodontal probing and mobility were within normal limits. The tooth did not respond to Electric Pulp Test (EPT). IOPAR (intraoral periapical radiograph) revealed presence of apical radiolucency. The tooth was diagnosed with symptomatic irreversible pulpitis with apical periodontitis and endodontic treatment was suggested to the patient. Informed consent was taken. Treatment protocol was similar to case 1. In this case MB and DB root had Vertucci's type 4 and palatal root had Vertucci's type 2 configuration.



Case 3

A 22 year old female patient was referred to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospital presented with the chief complaint of pain in the left upper back tooth region. The recently developed pain was continuous and referred in nature, which aggravated on chewing food and required analgesics for relief. Patient also complained of pain at night. The patient's medical

history was non-contributory. Clinical examination revealed a tooth with a large mesial proximal carious lesion with respect to tooth no. 26, which exhibited percussion sensitivity. Periodontal probing and mobility were within normal limits. The tooth did not respond to Electric Pulp Test (EPT). IOPAR revealed widening of periodontal ligament space. The tooth was diagnosed with symptomatic irreversible pulpitis with periapical abscess and endodontic treatment was suggested to the patient. After caries excavation pre-endodontic buildup with composite restoration done. Informed consent was taken. Treatment protocol was similar to case 1. In this case MB root had Vertucci type 4 and DB root and palatal root had Vertucci's type 2 configuration.



2. Discussion

Based on the literature and this clinical case series, it is evident that knowledge of the anatomical variations of the maxillary molars is extremely important for the success of endodontic treatment. According to Cohen and Burns canals are often not treated because they are not located. Despite Krasner and Rankow having defined the laws of orifice location of the root canals & about access, it is most important that careful attention is paid to any evidence of additional canals. A palatal root with two or more different canals has rarely been described.[3]

Endodontic access should be designed to provide direct access to the apical third of the root canal system. The dentist should be able to visualize all aspects of the coronal third of the root canal system, and all tooth structure or restorative material that interferes with straight line access should be removed. To achieve a straight-line access, the conventional triangular access cavity can be modified into many shapes such as clover leaf–like (shamrock), heart, trapezoidal, rectangular, rhomboidal, and ovoid shapes, depending on the particular clinical situation. In these presented cases the conventional triangular access was prepared first, and then it was modified during exploration of extra canals.[6]

Cases highlights the unusual anatomy of maxillary molars with double canals in all three roots. The concurrent incidence of dual canal systems in all three roots of maxillary first molars is an uncommon finding.[1]

Different methods of locating extra canals have been discussed by many authors.

1) Additional off-angle radiographs.
2) Use of computed tomography.
3) Use of magnification (loupes and dental operating microscopes).
4) Examine dentinal map minutely and use DG16 to explore the floor of the pulp chamber.
5) Look for hemorrhagic spots (indicate the presence of extra canals).
6) Perform champagne or bubble test with sodium hypochlorite.
7) Staining the pulp chamber with dye (eg, 1% methylene blue).
8) Use of ultrasonic tips, special round burs, and thin tapering finishing burs to remove a small amount of tooth structure or calcification and trough the line angles of the pulp chamber will help.
9) Modify the conventional outline form to include the extra canals.
10) Ensure adequate straight-line access to improve visibility.[6]

Studies done on maxillary first molars have reported the highest incidence of the second mesiobuccal canal (18.6%–96.1%), followed by mesiopalatal (56.8%), then second distobuccal (1.6%–9.5%), and the least distopalatal (1.7%) canals.[1]

The occurrence of a second root canal in the DB root is merely 1.12%–9.5% with 98% of cases having a single apical exit similar to that reported in the current case.[7]

A majority of studies confirmed that younger patients (20–40 years) have a higher incidence of additional root canals when compared to older individuals. This may be due to the increase in calcifications of the root canal spaces and orifices with advancing age, hindering the detection of additional canals in older patients. The anatomical variations could also be attributed to demographic factors such as sex and ethnicity as well as geographical location.[7]

Wheeler said, in the macroscopic approach to diagnosis and manipulative prognosis in endodontics, it is always worthwhile to review dental anatomy.[8]

Peikoff et al. reported six variations of a second maxillary molar in a retrospective study as Three distinct roots and canals (56%), three separate roots and four canals (two mesiobuccal canals) (22.7%), three roots and canals uniting mesiobuccal and distobuccal canals (9%), two separate roots and canals (6.9%), a single root with one canal (3.1%), and four roots or canals including two palatal canals (1.4 %).[9]

According to this classification, our series falls into the latter group. The palatal root had two canals merging to one apex (type II Vertucci). Such cases have already been reported by Benenati.[9]

Zheng et al. indicated that there was a low incidence (0.31%) of 775 CBCT images of maxillary first molars with six root canals; however, anatomic variation studies in the second

maxillary molars were not numerous. Pasternak et al. described a second maxillary molar with six canals. We also observed that the mesiobuccal and distobuccal root canals in the maxillary second molar were long and narrow.[10]

The higher incidence of multiple canals in the mesiobuccal root as compared to the distobuccal root could possibly be due to the mesiobuccal root being broad buccolingually while the distobuccal root is round or ovoid in cross-section.[2]

Another difficulty is the tortuous pathway of some of these canals, which can include one or two abrupt curves in the coronal portion.[11] The second mesiobuccal canal (MB2) is one of the most commonly undetected canals in maxillary molars that escapes the pulp chamber at a critical mesial inclination, and consequently bends distally making the task difficult for dental practitioners.[12]

Different canal configurations might require varying root canal procedures to facilitate complete cleaning, disinfection, and canal obturation. Of particular interest is that there was no significant difference between locating the MB2 with the use of the microscope or the use of loupes.[5] Maggiore et al. and Adanir et al. reported six root canal configuration. [13]

Understanding the anatomical variations of the root canal system is essential to the success of endodontic treatment. The main goal of this treatment is to prevent apical pathosis and promote healing. One reason for failure is the inability to clean, negotiate, or obturate all existing root canals. Root canals may not be cleaned because the dentist fails to detect their presence.[14]

3. Conclusion

The series of case reports presented here emphasizes on the incidence of additional canals in maxillary first & second molars. Hence, a thorough familiarity with root and root canal morphology and a good anticipation of their likely morphological disparities is crucial and will help in reducing endodontic failures caused by inadequate root canal preparation and obturation. Variations in root morphology although a rare occurrence, their importance should not be underestimated.

References

[1] Kotia R, Chhabra S, Goyal S. Endodontic management of six-canalled maxillary first molar: a case report. Int J Appl Dent Sci 2020; 6: 178-81.
[2] Nur BG, Ok E, Altunsoy M, Aglarci OS, Colak M, Gungor E. Evaluation of the root and canal morphology of mandibular permanent molars in a south-eastern Turkish population using cone-beam computed tomography. Eur J Dent 2014;8:154-9.
[3] Pasternak Júnior B, Teixeira CS, Silva RG, Vansan LP, Sousa Neto MD. Treatment of a second maxillary molar with six canals. Aust Endod J 2007; 33:42-5.
[4] Alhujhuj RR, Jouhar R, Ahmed MA, Albutayh MT, Adanir N. Evaluation of root canal configuration of maxillary and mandibular first molar by CBCT: a retrospective cross-sectional study. J Contemp Dent Pract 2023; 24: 134-40.
[5] Buhrley LJ, Barrows MJ, BeGole EA, Wenckus CS. Effect of magnification on locating the MB2 canal in maxillary molars. J Endod 2002; 28: 324-7.
[6] Karthikeyan K, Mahalaxmi S. New nomenclature for extra canals based on four reported cases of maxillary first molars with six canals. J Endod 2010; 36: 902–905.
[7] Kadulkar N, Kataki R, Deka A, Pharne V. Endodontic management of a maxillary first molar with three roots and six root canals: a case report. J Conserv Dent 2021; 24: 517-20.
[8] Prabha MV, Sinha S, Kumar SVK, Haragopal S. Maxillary Molar with Two Palatal Canals. J Contemp Dent Pract 2012; 13: 905-7.
[9] Nabavizadeh M., Abbaszadegan A., Mirhadi H., Ghahramani Y. Root Canal Treatment of a Maxillary Second Molar with Two Palatal Canals: a Case Report. Dent Shiraz Univ Med Sci 2015; 16: 371-3.
[10] Lin Y, Xiang Y, Chen X, Wang H, Cao N, Xu X, Zhang Y, Wu Z. Multiple root canals in the maxillary molar: an unusual case report. BMC Oral Health 2020; 20: 1-6.
[11] Peeters HH, Suardita K, Setijanto D. Prevalence of a second canal in the mesiobuccal root of permanent maxillary first molars from an Indonesian population. J Oral Sci 2011; 53: 489-94.
[12] Alhujhuj RR, Jouhar R, Ahmed MA, Almujhim AA, Albutayh MT, Adanir N. Evaluation of root canal configuration of maxillary and mandibular first molar by CBCT: a retrospective cross-sectional study. Diagnostics (Basel) 2022; 12: 2121.
[13] Maggiore F, Jou YT, Kim S. A six-canal maxillary first molar: case report. Int Endod J 2002; 35: 486-91.
[14] Zhang ZH, Yao HL, Zhang Y, Wang X. Endodontic management of the maxillary first molar with special root canals: A case report and review of the literature. World J Clin Cases 2020; 8: 2590-6.