CLINICAL DENTISTRY AND RESEARCH 2020; 44(1): 30-40 Case Report

ROOT CANAL TREATMENT OF MAXILLARY MOLARS WITH DOUBLE PALATAL ROOTS: CASE SERIES

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ABSTRACT

This case series reports the root canal treatment of five maxillary second molars with double palatal roots. Maxillary second molars are usually three-rooted, but rare cases may demonstrate the presence of four roots. Although this morphology is uncommon in clinical settings, a clinician should understand the complexities involved in the management of such cases.

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ÇİFT PALATAL KÖKE SAHİP MAKSİLLER MOLAR DİŞLERİN KÖK KANAL TEDAVİSİ: VAKA SERİSİ

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ÖZ

Bu vaka serisinde çift palatal köke sahip 5 tane maksiller ikinci molar dişin kök kanal tedavisi bildirilmektedir. Maksiller ikinci molar dişler genellikle üç köklüdürler ama çok nadir durumlarda dört köklü olabilmektedirler. Her ne kadar bu morfoloji yaygın görülmese de, hekimler klinikte bu vakalarla karşılaştıklarında kök kanal sistemi karmaşıklığını anlamalıdırlar.

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INTRODUCTION

Successful root canal treatment (RCT) depends on a thorough understanding of the canal morphology and the effectiveness of cleaning, disinfection, and filling procedures. Knowledge of the canal morphology and variations provides pain relief in patients, prevents recurrence of infection, and contributes to the long-term success of RCT.[1] A study of teeth that did not respond to RCT showed the presence of missed extra root canals that resulted in the persistence of infection and treatment failure.[2] Therefore, clinicians should be aware of the root canal morphologies, configurations, and possible variations. Teeth with missed canals were 4.38 times more likely to be associated with lesions.[3]

Maxillary molars have been frequently investigated due to anatomic variations,[4-8] and several studies have shown that they have high rates of endodontic failure.[9] Moreover, the presence of multiple canals restricts instrumentation and creates endodontic treatment challenges.[10] Maxillary first molars (MFM) generally have three roots with four canals. Most maxillary second molars (MSM) have three separate roots (mesiobuccal [MB], distobuccal [DB], and palatal); however, they show a higher incidence of variations in number and morphology of roots than MFMs.[5,6] Depending on the type of root fusion, the incidence of one or two roots has been described in one out of four cases, whereas the presence of four roots is extremely rare.[8] Several variations of MSMs have been reported, such as two distal roots, one mesial and one palatal root, three buccal roots (MB, DB, and mid-buccal), and one palatal root.[8] Zeng et al.[10] treated a MSM with four roots and five canals, which had a C-shaped MB root with two canals, two fused DB roots, and one bulky palatal root. Sha et al.[11] reported a case of MSM with four roots and five canals, which had one MB root with two MB canals, one DB root and canal, and two palatal roots with two palatal canals. Moreover, some studies have reported MSMs with more than one palatal canal in one root.[12]

This report presents RCTs of five MSMs with four roots, which are rarely seen.

CASE REPORTS

General Procedures

All the patients were female with non-contributory medical histories. The patients were administered 4% articaine with 1:100,000 epinephrine (Ultracain DS, Sanofi, Turkey) as a local anesthetic. Before access cavity preparation, the teeth were isolated using a rubber dam. Working lengths were measured using Root ZX mini (Morita, Osaka, Japan) and Propex Pixi (Dentsply Maillefer, Ballaigues, Switzerland) electronic apex locators. Periapical radiographs were taken to confirm the correct working length. The canals were initially instrumented with a #10 K-file (M-ACCESS; Dentsply Maillefer), and a glide path was created with a rotary file (Proglider, Dentsply Maillefer). Root canals were instrumented with ProTaper Next (Dentsply Maillefer) rotary files. During instrumentation, a copious amount of 2.5% NaOCl was used for irrigation, followed by 17% EDTA for 1 minute. Final irrigation was performed with 2% chlorhexidine digluconate before filling the root canal. The cold lateral compaction technique was used to fill the root canals with gutta-percha and 2Seal (VDW, Munchen, Germany) root canal sealer.

Case 1

A 51-year-old patient reported to the general dentist with occasional swelling and pain in the right maxillary molar region and wished to replace her fixed partial dental prosthesis. Clinical and radiographic examination revealed that teeth #14-17 had rebonded bridge restorations. Tooth #17 and #18 had deep dentinal caries and periapical lesions (Figure 1A). A fixed prosthesis to be fabricated in porcelain was planned for the upper right region after RCT of both teeth. However, the practitioner diagnosed that tooth #17 had an unusual root canal anatomy with the possibility of extremely curved canals (Figure 1A). Therefore, the patient was referred to the private clinic of an endodontist (HA) for RCT of tooth #17.

Tooth #17 did not respond to thermal and electrical pulp tests and showed mild tenderness to percussion and palpation. To further investigate, the tooth was scanned by cone-beam computed tomography (CBCT) in a small field of view. The CBCT images showed that tooth #17 had four roots (MB, DB, mesiopalatal [MP], and distopalatal [DP]) (Figure 2A-C) and the presence of a large periapical lesion (Figure 1B). MB and MP roots were almost fused until root ends. There was also a fusion extending largely between the MB and DB roots. The fusion between the DB and DP roots continued to the mid-root level, while they ended separately (Figure 2A-I). All teeth exhibited the Vertucci type I canal configuration (Figure 2A-I).

Tooth #17 was diagnosed with chronic apical periodontitis, and the treatment was completed in 2 visits (Figure 1C). Calcium hydroxide was placed as an intracanal medicament between visits. The tooth was restored with glass ionomer

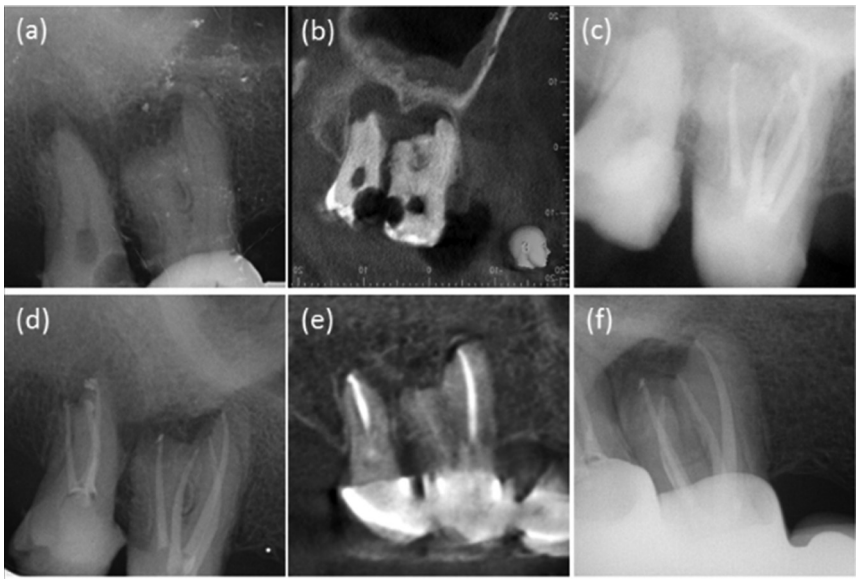


Figure 1. (A) initial radiograph, (B) sagittal section of the relevant region shows a periapical lesion associated with teeth #17 and #18, (C) filling of tooth #17, (D) 3-month follow-up, (E, F) 20-month follow-up.

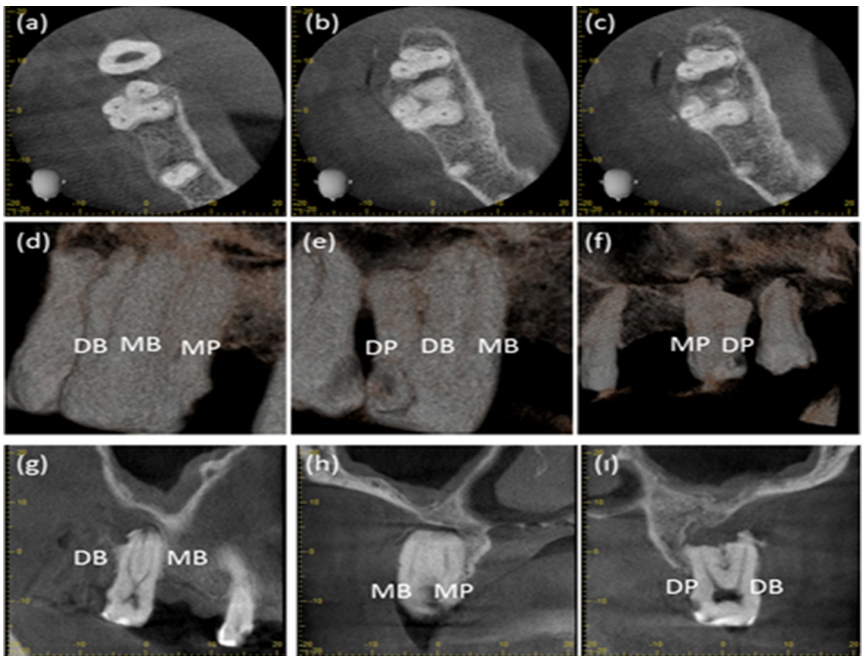


Figure 2. (A, B, C) axial slices at coronal, middle, and apical third, (D, E, F) 3D reconstruction of tooth #17 in Case 1, (G) buccal canals at the sagittal slice, (H) mesial and (I) distal canals at the coronal plane.

cement, and the patient was referred to the general dentist for the remaining treatment. At a 3-month follow-up, the patient was clinically asymptomatic, and the lesion showed signs of resolution (Figure 1D). Twenty months later, the periapical pathology demonstrated significant healing (Figure 1E, F).

Case 2

A 31-year-old patient reported to the dentist with a toothache that exacerbated, especially at night, waking her up. The tooth had a deep filling and showed a radiopacity in the furcation area (Figure 3A). RCT was initiated, but some canals could not be located due to changes in the

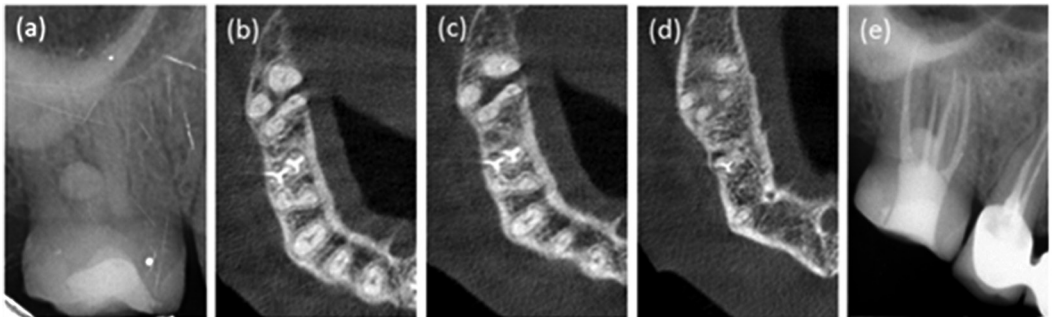


Figure 3. (A) initial radiograph, (B, C, D) axial slices at coronal, middle, and apical third, respectively, (E) filling of tooth #27.

anatomic position of canal orifices. The dentist sealed the tooth with a temporary filling and referred the patient to an endodontist (HA). The periapical radiograph suggested that the radiopacity in the furcation was an enamel pearl. A CBCT image taken to facilitate better visualization of root canal morphology showed the presence of four roots (MB, DB, MP, and DP) (Figure 3B-D). MB and MP roots were fused just until 2 mm of the apex but ended separately. The other roots were not fused. All teeth showed the Vertucci type I configuration (Figures 3B-D and 4A-D). The enamel pearl was present just above the cementoenamel junction on the palatal side of the tooth (Figure 4E-F).

After the removal of temporary filling, all the canals were located, and RCT was performed in the same visit (Figure 3E). At the 15-day follow-up, the patient had no pain or discomfort.

Case 3

A 32-year-old patient visited the general dentist with a prolonging pain in the left maxillary left region that was aggravated by cold and exacerbated during the night. Tooth #27 had deep caries combined with sensitivity to percussion. CBCT images taken for dental implant assessment showed that tooth #27 had four roots. As the dentist planned to fabricate crown restorations for teeth #26 and #27, he prepared the teeth and referred the patient to the private clinic of an endodontist (HA). The tooth was considered vital following thermal and electric pulp tests. There was no abnormality detected in the surrounding tissues on radiographs (Figure 5A). The diagnosis was acute pulpitis. CBCT image showed the presence of four roots (MB, DB, MP, and DP). The mesial roots showed fusion up to the apex, whereas the others were separate, without any fused area (Figures 6A-D). All the teeth exhibited Vertucci type I configuration. (Figure 5B, C). RCT was completed in a single visit (Figure 5D). Glass ionomer cement was used for filling, and the patient was referred to her dentist for the remaining treatment.

Case 4

A 50-year-old patient reported to the periodontist the complaints of pain, swelling, and bleeding gums. A 5-6 mm deep pocket was detected on the mesial root of tooth #27. The old crown restoration was removed, and a flap operation was performed after scaling and root planning. A temporary crown was fabricated, but the patient came complaining of pain and extreme sensitivity to cold. Therefore, RCT was planned, and the patient was referred to the private clinic of an endodontist (HA).

During clinical examination, the tooth was highly sensitive to cold stimuli but showed no tenderness on percussion and palpation. Radiographic examination revealed severe bone loss around the MB root with no evidence of a periapical lesion (Figure 7A). The diagnosis was symptomatic pulpitis. The conventional triangular-shaped access cavity was modified to a rectangular shape due to a variation in the position of the palatal orifice (Figure 10D). RCT was completed in a single visit (Figure 7D-F). At the 15-day follow-up, the patient had no complaints of pain or discomfort. CBCT image taken for dental implant assessment showed that all the roots ended separately (Figure 8A-C).

Case 5

A 28-year-old patient reported to the dentist with the complaint of a fractured filling in an otherwise asymptomatic tooth. Clinical examination revealed a deep filling and crown fracture extending up to the palatal gingiva. Radiographic examination showed an endodontically treated tooth that was filled short of the apex. There was no evidence of a periradicular lesion (Figure 9A). Retreatment was



Figure 4. (A) distal roots at the coronal plane, (B) mesial roots at the coronal plane, (C) buccal roots at the sagittal plane, (D) palatal roots at sagittal planes, and (E, F) enamel pearl on the palatal side.

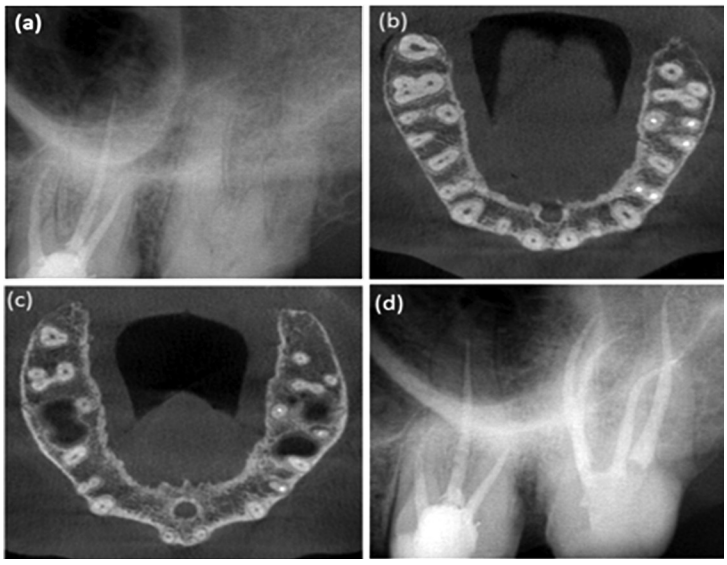


Figure 5. (A) initial radiograph, (B, C) axial slices at middle and apical third, (D) filling.

considered, and the root canal filling was removed using ProTaper retreatment rotary files (Dentsply Maillefer). The operator attempted to negotiate the canals with #10 K-files but could not reach the apical foramen due to cementum deposition obliterating the foramina (Figure 9B). RCT was completed in a single visit, and the cavity was filled with glass ionomer cement (Figure 9C). For the prosthetic treatment, the patient was referred to the prosthodontist.

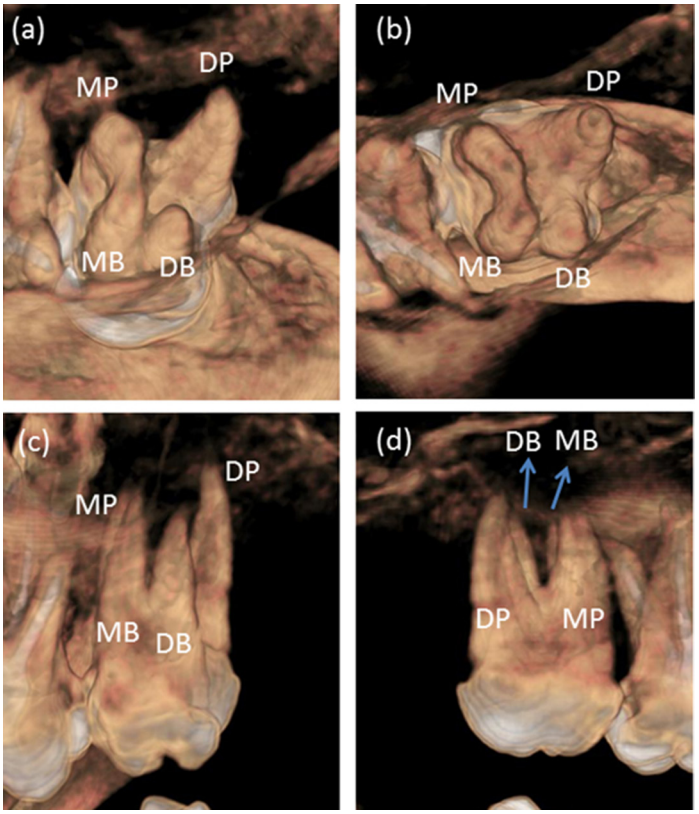


Figure 6. 3D reconstruction of tooth #27 in Case 3, (A, B) upper view. Presence of fusion between MB and MP roots, (C) buccal view, (D) palatal view.

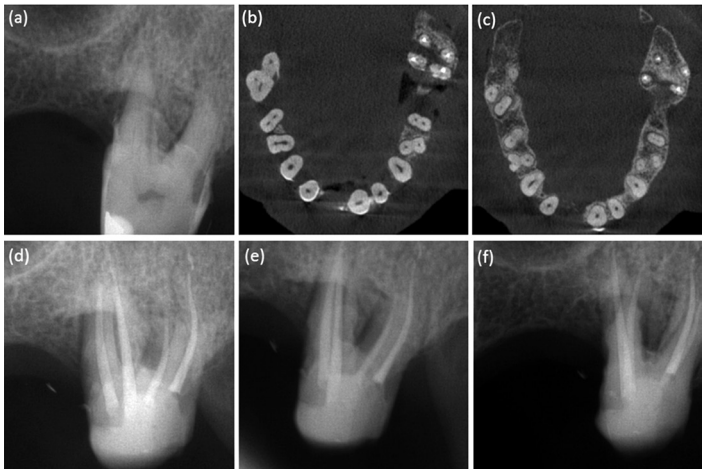


Figure 7. (A) preoperative radiograph of tooth #27 in Case 4, (B, C) axial slices at middle and apical third, (D-F) postoperative radiograph.

DISCUSSION

The first classification of maxillary molars with two palatal roots was proposed by Christie et al.[13] They analysed 16 endodontically treated and 6 extracted molars and classified these 22 teeth according to the divergence and the level of separation of the roots. They categorized four-rooted maxillary molars into three types. Type I maxillary molars have two widely divergent palatal roots that are often long and tortuous, while buccal roots are often 'cow-horn' shaped and less divergent. Type II maxillary molars often have shorter, parallel buccal and lingual root morphology and four separate roots. In Type III maxillary molars, the DB root

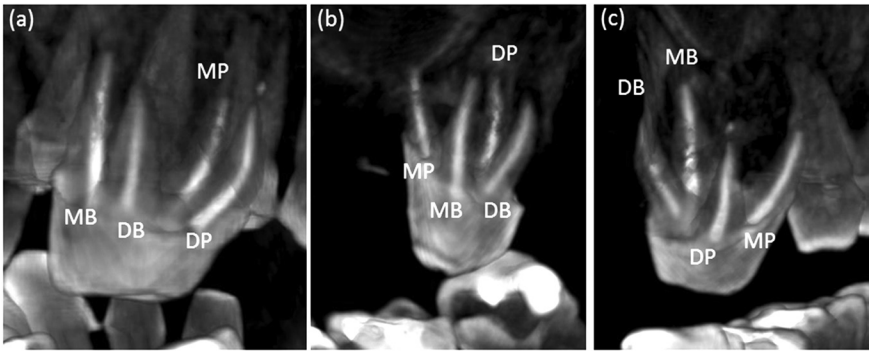


Figure 8. 3D reconstruction of tooth #27 in Case 4. (A) distobuccal view, (B) buccomesial view, (D) palatodistal view.

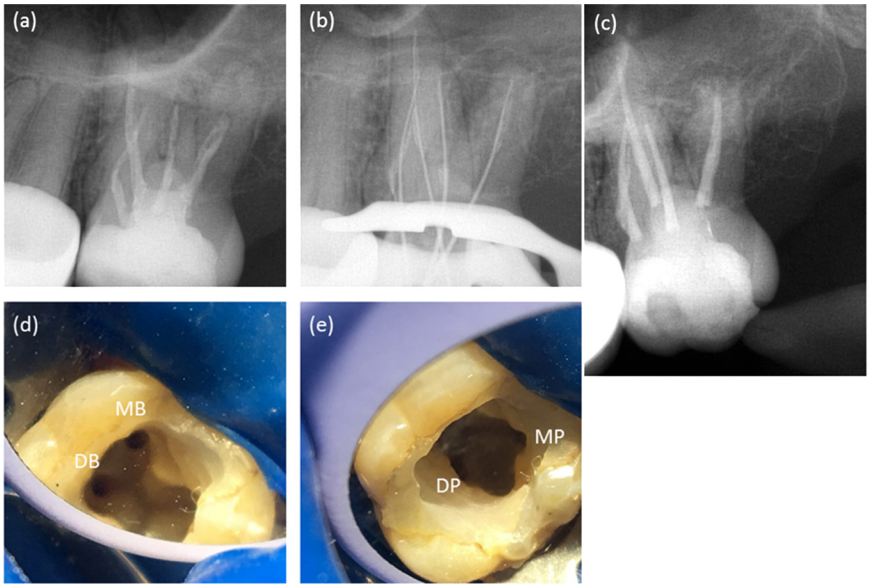


Figure 9. (A) initial radiograph, (B) working length determination, (C) after root canal treatment, (D, E) canal orifices.

stands alone, but the MB, MP, and DP roots merge through root dentin. Subsequently, Baratto-Filho et al.[1] reported a variation that did not belong to these three categories and classified it as Type IV. Teeth in this category have a palatal root with two distinct root canals fused with the MB root up to the apical level. However, Versiani et al.[14] stated that the fusion of roots may occur at different levels and is difficult to distinguish clinically. They proposed a new classification based on the divergence of the roots. Type I: Same as Christie's classification; Type II: Christie's Types II and III were combined into one category; Type III: Palatal roots were less divergent and often shorter than buccal roots that were widely divergent.

Gu et al.[15] analyzed 13 four-rooted maxillary molars and found two teeth with three buccal roots and one palatal root. They described this variation as Type IV. In the present 5 cases, we observed that clinical differentiation was difficult, and we could obtain detailed information on root morphology from CBCT images. Hence, we selected the Versiani classification. In case 1, although the palatal roots were slightly more divergent, there was little difference between the buccal roots, and the morphology was classified as type I. However, the MB and MP roots were fused to the apical level, and there was a wide range of fusion between the buccal roots. The DB root was separate from the others after the middle third. In case 2, the divergence was very similar between the buccal and the palatal roots, and the morphology was classified as type II. As in case 1, the mesial roots were fused to the apical level. The distance between the apical foramina of the distal roots was considerably

greater than the distance between the other roots, and divergence was observed between the distal roots. At the same time, the mesial roots were smaller, while the DP root was considerably larger than the other roots. In case 3, the palatal roots were more divergent than the buccal roots, and the morphology was classified as type I. As in cases 1 and 2, the mesial roots were fused to the apical level. As in case 2, the DB root was bulkier than the other roots. In case 4, as in cases 1 and 2, the palatal roots were slightly more divergent than the buccal roots but ran parallel to each other, and the morphology was type II. However, there were no fusion between any root, which differed from the previous cases, and all roots began and ended separately. Moreover, the mesial roots were bulkier than the distal roots. In case 5, no CBCT image was taken, but the orifices of the palatal canals were wider than the buccal canal orifices, and the morphology was classified as type II, based on radiographs. Intra-oral periapical radiographs showed that the MB, MP, and DP roots were either grouped or fused, and DB roots were distinct (similar to Christie's Type III classification).

Christie et al.[13] reported that this rare morphology was encountered every three years in endodontic clinics. In the Chinese population, the incidence of two palatal roots in MFMs and MSMs was 0.06% and 1.2%, respectively.[5] Lin et al.[4] were unable to find two palatal roots in MFMs in the Taiwanese population. However, they estimated a 0.9% incidence of two palatal roots in the MSMs. Similarly, Kim et al.[8] did not encounter two palatal roots in MFMs in the mongoloid Korean population. However, they reported a 0.49% incidence of two palatal roots in MSMs. Of the 16 four-rooted teeth, 12 had two palatal roots, two teeth had two distal roots, and two teeth had mid-buccal roots for extra roots. In the Thai population, this ratio was found to be the same, with a 0.2% incidence for MFMs and MSMs.[6] In a study comparing Asians and whites, the incidence of four-rooted MSMs was 1.7% and 0.5%, respectively.[16] In some studies, the incidence of four roots was not found in both maxillary molars.[7] In the current case series, all the cases were MSMs, similar to the studies mentioned above. All roots had a single canal, and these findings were confirmed by CBCT.

Although the MB roots of maxillary molars have a higher incidence of two canals than one, the MB roots of four-rooted maxillary molars generally exhibit single canal morphology. In a study by Tian et al.[5], canals of all four-rooted teeth (1 MFM and 18 MSMs) showed a Vertucci type I configuration. Similarly, in a study by Gu et al.[15], all the four-rooted teeth (1 MFM and 12 MSMs) had a single canal. Unlike these CBCT studies, a micro-CT study[14] showed that only 4 of the 25 (24%) four-rooted MSMs were found to have second mesiobuccal (MB2) canal, which is lower than other micro-CT studies.[17]

The aetiology of double palatal roots is still unknown. It is believed that exogenous and endogenous factors may cause disturbances in the formation of the Hertwig's epithelial root sheath during root development.[18] The reason that the incidence of MB2 is so low in four-rooted palatal teeth is that extra root may be separated from MB root.[15] Our cases, except case 4, showed fusion between the MB and MP roots. However, further studies should be conducted to confirm our findings.

Anatomical variations can be seen in each group of teeth, and clinicians should use different methods to understand the complexity of the root canal system. Once the access cavity has been prepared, the bubbling effect can be used with sodium hypochlorite to locate additional canal orifices. The laws of symmetry, color change, and orifice location can be used.[19] Periodontal and root probing before rubber dam placement can help to understand the morphology of the root trunk in four-rooted cases.[13]

Although periapical films taken from different angles are helpful, especially in the maxillary molar region, the surrounding anatomical structures may superimpose on the radiographs, and distortion of roots may occur. It becomes difficult to interpret the image and obtain complete knowledge before the treatment.[11] An additional shifted radiograph may be useful to detect anatomical variations.[11] CBCT should be used if this method does not work. CBCT examination before or during treatment enables the detection of hidden canals.[10,20] CBCTs have recently become very popular in endodontics because of their advantages, such as short scanning times (10-70 sec) and much lower radiation dosages than conventional CTs. Taking into account the ALARA (as low as reasonably achievable) principles, the use of all armamentaria provides clinicians with great ease in the treatment of such cases.[21]

Access cavities of the four-rooted maxillary molars should be prepared wider than usual in the palatal direction (Figure 10A-E). Standard triangular access forms prepared in three-rooted maxillary molars are insufficient to localize the root canal of the fourth root. Therefore, the access outline should be trapezoidal rather than triangular or square.[14]

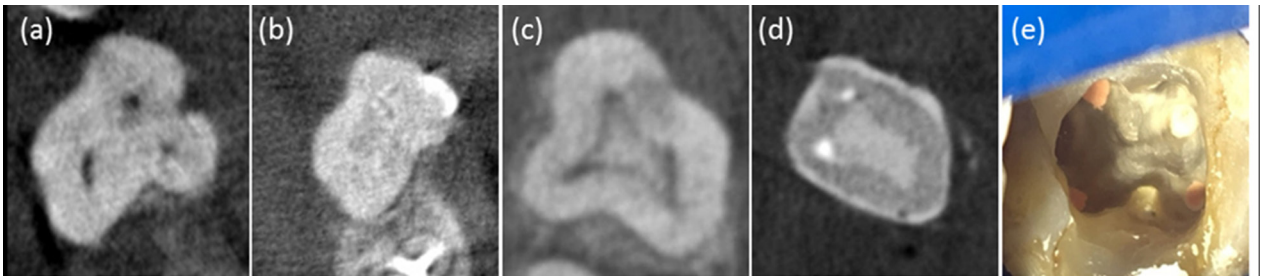


Figure 10. Axial sections at the level of the canal orifices showing the shape of the access cavities. (A) Case 1, (B) Case 2, (C) Case 3, (D) Case 4, (E) Case 5.

Especially in type I cases, it may be challenging to visualize the location of the MP canal. Appropriately designed and prepared access cavities can help physicians locate canals.[22] Another interesting finding is the high incidence of enamel pearls in these teeth.[13,14] Enamel pearl is usually seen in furcation sites of the second and third maxillary molars. Enamel pearls represent the localized activity of portions of Hertwig's epithelial root sheath, which retain a latent potential to become functional ameloblasts and enamel organ that produces enamel deposits on the root.[23] Christie et al.[13] reported enamel pearls in 3 of the 22 teeth they investigated. Versiani et al.[14] reported the presence of enamel pearls in 2 teeth in a 25-teeth micro-CT study. In the present case series, enamel pearl was present in only one case. Although the incidence of enamel pearl is 0.82% among all teeth and only 1.71% among molars, studies are needed to determine the higher incidence in four-rooted maxillary molars.[24]

CONCLUSIONS

Although clinically unlikely to be associated with double palatal roots, clinicians should be aware of each canal configuration and know what to look for in terms of the success of treatment when encountered. CBCT is useful for the dentist in understanding the root canal and root morphology in such teeth.

REFERENCES

1. Baratto-Filho F, Fariniuk LF, Ferreira EL, Pecora JD, Cruz-Filho AM, Sousa-Neto MD. Clinical and macroscopic study of maxillary molars with two palatal roots. Int Endod J 2002; 35: 796-801.

2. Lin LM, Rosenberg PA, Lin J. Do procedural errors cause endodontic treatment failure? J Am Dent Assoc 2005; 136: 187-193.

3. Karabucak B, Bunes A, Chehoud C, Kohli MR, Setzer F. Prevalence of apical periodontitis in endodontically treated premolars and molars with untreated canal: A cone-beam computed tomography study. J Endod 2016; 42: 538-541.

4. Lin YH, Lin HN, Chen CC, Chen MS. Evaluation of the root and canal systems of maxillary molars in Taiwanese patients: A cone beam computed tomography study. Biomed J 2017; 40: 232-238.

5. Tian XM, Yang XW, Qian L, Wei B, Gong Y. Analysis of the Root and Canal Morphologies in Maxillary First and Second Molars in a Chinese Population Using Cone-beam Computed Tomography. J Endod 2016; 42: 696-701.

6. Ratanajirasut R, Panichuttra A, Panmekiate S. A Cone-beam Computed Tomographic Study of Root and Canal Morphology of Maxillary First and Second Permanent Molars in a Thai Population. J Endod 2018; 44: 56-61.

7. Pérez-Heredia M, Ferrer-Luque CM, Bravo M, Castelo-Baz P, Ruíz-Piñón M, Baca P. Cone-beam Computed Tomographic Study of Root Anatomy and Canal Configuration of Molars in a Spanish Population. J Endod 2017; 43: 1511-1516.

8. Kim Y, Lee SJ, Woo J. Morphology of maxillary first and second molars analyzed by cone-beam computed tomography in a Korean population: Variations in the number of roots and canals and the incidence of fusion. J Endod 2012; 38: 1063-1068.

9. Wolcott J, Ishley D, Kennedy W, Johnson S, Minnich S, Meyers J. A 5 yr clinical investigation of second mesiobuccal canals in endodontically treated and retreated maxillary molars. J Endod 2005; 31: 262-264.

10. Zeng C, Shen Y, Guan X, Wang X, Fan M, Li Y. Rare root canal configuration of bilateral maxillary second molar using cone-beam computed tomographic scanning. J Endod 2016; 42: 673-677.

11. Sha X, Sun H, Chen J. Maxillary second molar with four roots and five canals. J Dent Sci 2018; 13: 167-171.

12. de Almeida-Gomes F, Maniglia-Ferreira C, dos Santos RA. Two palatal root canals in a maxillary second molar. Aust Endod J 2007; 33: 82-33

13. Christie WH, Peikoff MD, Fogel HM. Maxillary molars with two palatal roots: A retrospective clinical study. J Endod 1991; 17: 80-84.

14. Versiani MA, Pécora JD, De Sousa-Neto MD. Root and root canal morphology of four-rooted maxillary second molars: A micro-computed tomography study. J Endod 2012; 38: 977-982.

15. Gu Y, Wang W, Ni L. Four-rooted permanent maxillary first and second molars in a northwestern Chinese population. Arch Oral Biol 2015; 60: 811-817.

16. Martins JNR, Gu Y, Marques D, Francisco H, Caramês J. Differences on the Root and Root Canal Morphologies between Asian and White Ethnic Groups Analyzed by Cone-beam Computed Tomography. J Endod 2018; 44: 1096-1104.

17. Alfouzan K, Alfadley A, Alkadi L, Alhezam A, Jamleh A. Detecting the Second Mesiobuccal Canal in Maxillary Molars in a Saudi Arabian Population: A Micro-CT Study. Scanning 2019; Article ID 9568307, 6 pages.

18. Nanci A. En Cate: Oral Histology : Development, Structure and Function. Nanci A, Ten Cate A Ten cate oral Histol Dev Struct Funct Missouri Mosby; 2013.

19. Krasner P, Rankow HJ. Anatomy of the pulp-chamber floor. J Endod 2004; 30: 5-16.

20. Studebaker B, Hollender L, Mancl L, Johnson JD, Paranjpe A. The Incidence of Second Mesiobuccal Canals Located in Maxillary Molars with the Aid of Cone-beam Computed Tomography. J Endod 2018; 44: 565-570.

21. Gopikrishna V, Reuben J, Kandaswamy D. Endodontic management of a maxillary first molar with two palatal roots and a single fused buccal root diagnosed with spiral computed tomography - a case report. Oral Surgery, Oral Med Oral Pathol Oral Radiol Endodontology. 2008; 105: 74-78.

22. Aggarwal V, Singla M, Logani A, Shah N. Endodontic Management of a Maxillary First Molar with Two Palatal Canals with the Aid of Spiral Computed Tomography: A Case Report. J Endod 2009; 35: 137-139.

23. Kaminagakura E, Salmon CR, Fonseca DC, Lopes MCA, Tango RN. Prevalence and microscopic features of enamel pearls from permanent human molars. Brazilian J Oral Sci 2011; 10: 268-271.

24. Chrcanovic BR, Abreu MHNG, Custódio ALN. Prevalence of enamel pearls in teeth from a human teeth bank. J Oral Sci 2010; 52: 257-260.