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CASE REPORT

Bilateral Four-Rooted Maxillary Second Molars: A Case Report with Cone-Beam Computed Tomography Analysis

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ABSTRACT

Deeper understanding of root canal anatomy is fundamental for successful endodontic treatment. Two palatal roots in maxillary second molars, although uncommon, can be encountered in clinical practice. Advanced diagnostic tools like cone beam computed tomography (CBCT) plays a pivotal role in identification and management of this type of complex anatomy. This case report presents endodontic management of maxillary second molar with two palatal canals using CBCT and magnification.

Keywords: Dental Pulp Cavity, Maxillary Molar, Palatal Canals, Tooth Root, 3D imaging

Authors' Contribution:
All authors contributed equally to the conception, literature search, manuscript drafting, editing and review

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Introduction

For successful root canal treatment the thorough disinfection of entire root canal space is essential, and for this it is crucial to have a comprehensive knowledge of dental anatomy and its potential variations. Failure to identify radicular pulp space anatomy before initiating treatment, can significantly compromise the treatment outcome.[1] Continuous education and awareness on evolving techniques and use of advance diagnostics tools such as CBCT is vital for dentists to successfully manage the challenges posed by unusual root canal configurations.[2] According to literature 42% of teeth that require re-endodontic treatment had missed root canals, indicating a significant incidence of overlooked root canals.[3]

One of the common teeth to have variable configurations are the maxillary molars. Anatomical variations in maxillary second molars have been reported in several studies.[4] The maxillary second molars typically has 1 canal in each of the three roots, but variations such as two or three mesiobuccal canals, two distobuccal canals and two palatal canals have been observed. As compared to mesiobuccal and distobuccal canals the incidence of two palatal canals is relatively low (0.73%-2%).[5]

This case report aims to present the case of bilateral upper second molars with four roots (two palatal canals mesio-palatal (MP) and disto-palatal (DP), one mesio-buccal (MB) and one disto-buccal DB), and to highlight the importance of exploring root canal anatomy to improve patient care.

Case Presentation

A 36-years-old male reported to the department of Operative Dentistry and Endodontics at Islamabad Dental Hospital with the chief complaint of pain on right upper region of face. The pain was severe and

continuous in nature since past 3 days, which aggravated with chewing and did not subside with analgesics. He gave a history of root canal treatment of the same tooth one year back.

On clinical examination, the tooth had an occlusal restoration and was tender to percussion. Radiographic examination revealed a radiolucency present mesiooccluslally indicating secondary caries. The pulp chamber was filled with a radiopaque material suggesting a previous attempt at full pulpotomy possibly with zinc oxide eugenol. A diagnosis of previously initiated endodontic therapy with symptomatic apical periodontitis was established.

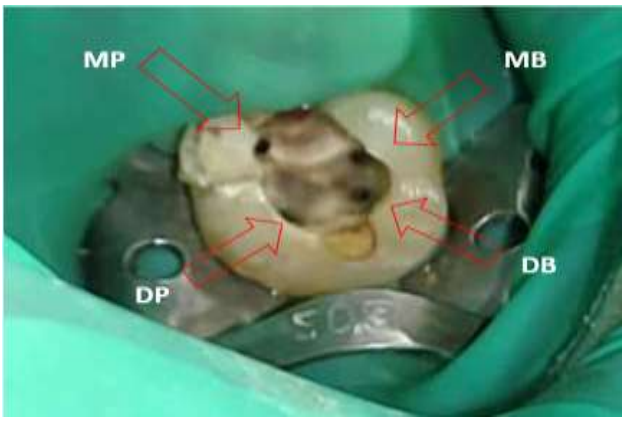

Figure 1. Trapezoidal access showing 4 root canals orifices

After informed consent, nonsurgical root canal treatment was planned. After administering posterior superior alveolar infiltration and isolation with rubber dam the access opening was reestablished. The entire chamber was found to be occluded probably with zinc oxide eugenol material. Based on the color difference the material was carefully removed using a round bur and the mesiobuccal (MB) canal was identified first, followed by the distobuccal (DB). The palatal canal was then located, which was found more mesially than usual, suggesting the possibility of a second palatal canal. After thorough mapping of the floor with DG 16 under 3.5x magnification, an orifice catch was found at the distopalatal (DP) site at the terminus of developmental fissure (figure 1) indicating the presence of additional palatal canal.

Figure 2: a) Working length radiograph with K files in buccal roots and H files in palatal roots, b) separated instrument in distobuccal root, c: Retrieved 5.5mm 10K file measured with CPITN probe

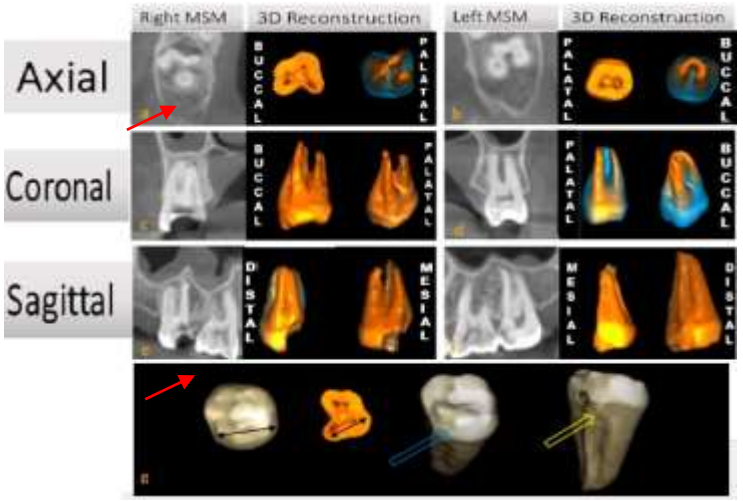

Figure 3: a,b) CBCT axial view with 3D reconstruction of right and left maxillary second molar, c,d) coronal view with 3D reconstruction of both molars, red arrow indicates the mucosal thickening of maxillary sinus. e,f) Sagittal view with 3D reconstruction, illustrating the buccal and palatal aspects of both molars, g) Macromorphological signs of four rooted left maxillary second molar, black double arrows indicates the palatal half to be widened, blue arrow indicates the double cusp of carabelli, yellow arrows indicates the thick enamel extention.

Working length was determined with apex locater and then reconfirmed with digital periapical radiograph (Figure 2a).

Following the initial appointment, an inter appointment calcium hydroxide dressing was placed and patient was advised to get cone bean computed tomography scan. However, the patient

subsequently visited another general dentist, who unfortunately separated a 5.5 mm 10K file in distobuccal canal (figure 2b). The separated instrument was successfully retrieved using braiding technique (figure 2c).

CBCT, revealed bilateral four rooted maxillary second molars. Right maxillary second molar (MSM) had fused MB, DB, MP roots while DP was separate. Left maxillary second molar had all four fused roots (figure 3). CBCT also revealed distinctive macromorphological traits of the left maxillary second molar, including a wider palatal half, thick enamel extension, and a double cusps of carabelli (figure 3g). These signs strongly suggested the presence of an additional root. Unfortunately, the crown of the right maxillary second molar was severely damaged, precluding a comparable analysis.

Cleaning and shaping of canals was carried out with protaper rotoray files using 2.5% sodium hypoclorite as an irrigant. Canals were dried with paper points obturated with sealapex sealer and Protaper F1 gutta purcha (Figure 4a,b,c). The tooth was restored with composite and patient was advised for crown.

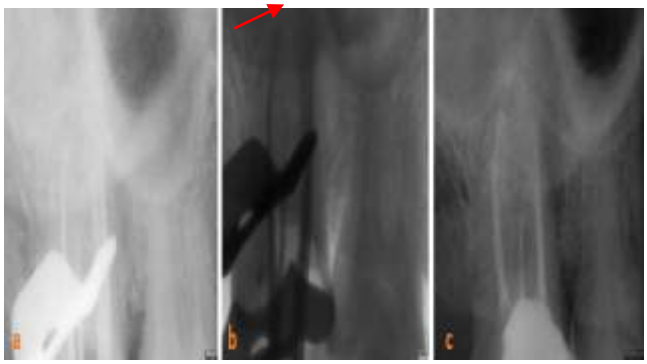

Figure 4: a, b) Radiograph of right MSM, master cone GP fit check, c) Post obturation radiograph

Discussion

Success of endodontic treatment depends upon a multitude of factors. Meticulous diagnosis, thorough inspection and knowledge of tooth and root canal morphology, angled preoperative radiographs, use of magnification and advanced diagnostic tools such as CBCT are the basic requirements especially in cases where variations from normal anatomy are encountered. Anatomical variations in the root canal morphology of maxillary second molars are relatively rare. However, several studies have reported varying prevalence rates of additional roots in maxillary second molars. In certain populations, the occurrence of four separate roots or canals including two palatal canals is only 1.4%.[6] Asian population, such as Indians and Chinese, exhibit higher prevalence rates of additional roots, with reported prevalence rates of 14% and 6% respectively but there is not much data for Iran, Pakistan and Afghanistan.[7] One recent study on Pakistani sub population reported 1.5% prevalence only, which is interestingly lower than other Asian contries.[8]

The prevalence of fused roots is much less as reported by previous studies with a prevalence of 0.8% for MB fused to P with separate DP and DB roots.[8] Our case report documents a more complex and rare variation, where right maxillary second molar exhibits four roots, with three fused roots and one disto-palatal root separated from the other three fused roots. The left maxillary second molar on the other hand had complete fusion of all four roots. Thorough assessment of crown morphology is also important. Sign that might indicate the possibility of additional roots are, presence of prominent palatal indentations, double carabelli cusps, wider palatal half of crown, thick palatal enamel extension, enamel pearls and palato radicular grooves. Significantly, previous studies reported that a wider palatal half of the crown was observed in 80% of cases with two palatal canals or roots,[9] which is consistent with our case, where a wider palatal aspect of the crown is evident (as indicated in figure 3g 3D reconstruction). Similarly, thick palatal enamel extensions and double cusp of carabelli can also be seen on the left maxillary second molar in the current case, indicating the importance of thorough clinical evaluation of the entire oral cavity.

Although the use of angled radiographs is important but limitations of 2D radiographs in detecting complex root anatomy, such as fused roots in our case. This highlights the significance of CBCT in correct diagnosis and treatment planning.[2] CBCT revealed bilateral maxillary second molars with rare anatomical variations, emphasizing the value of this diagnostic tool.

In addition to this, thorough exploration of floor with DG 16 and mapping proved valuable in this case.

Conclusion

This case report highlights the importance of thorough evaluation of macromorphological signs of crown and exploration of dentinal map for successful endodontic treatment. Moreover, use of magnification and three dimensional radiography cannot be overemphasized.

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