



**ORIGINAL RESEARCH PAPER**

**Dentistry**

**ENDODONTIC MANAGEMENT OF A MAXILLARY MOLAR WITH FOUR ROOTS AND ROOT CANALS DIAGNOSED USING MAGNIFICATION AND CBCT IMAGING: A CASE REPORT**

**KEY WORDS:** Maxillary second molar, Four roots, Dental loupes, CBCT Imaging

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**ABSTRACT** A thorough knowledge of the anatomy of the root canal system is elementary for successful endodontic outcomes. Maxillary second molars usually present with 3 roots of which, two are buccal and one is the palatal root. Incidence of an extra palatal root is an exceptional scenario and least documented. The present case report describes successful non-surgical management of a maxillary second molar with an unusual morphology of two palatal roots which were diagnosed using Dental loupes and CBCT Imaging.

**INTRODUCTION**

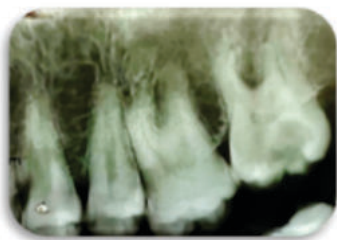
Successful endodontic treatment is an ability to locate all the roots and root canals, cleaning and shaping them with copious amounts of irrigant and providing a good apico-coronal seal all of which is possible only if the clinician has sound knowledge of the internal anatomy of the teeth and its variations. Inadequate knowledge of root canal morphology is directly proportional to the challenges encountered during the execution of endodontic therapy.

Root canal treatment has shown a success rate of 80-90% and a failure rate of 10%. Iatrogenic mishap of missed extra root(s) and canal(s) is one of the primary factors for endodontic treatment failure as it can initiate and sustain a periapical infection.<sup>2</sup>

Maxillary molars are teeth of clinical interest as they present a wide range of anatomical variations in their roots and root canals. Apart from the usual three-root anatomy of maxillary second molars, few studies have recorded the occurrence of an extra palatal root in maxillary second molar making an uncommon 'four root' scenario.<sup>3</sup>

Harry et.al in a study on 1,200 maxillary second molars concluded that only 0.4% of the teeth presented with four separate roots.<sup>4</sup>

The following case report describes an unusual case of maxillary second molar with two buccal and two independent palatal roots which was diagnosed using dental loupes and Cone beam computed tomography (CBCT) Imaging.



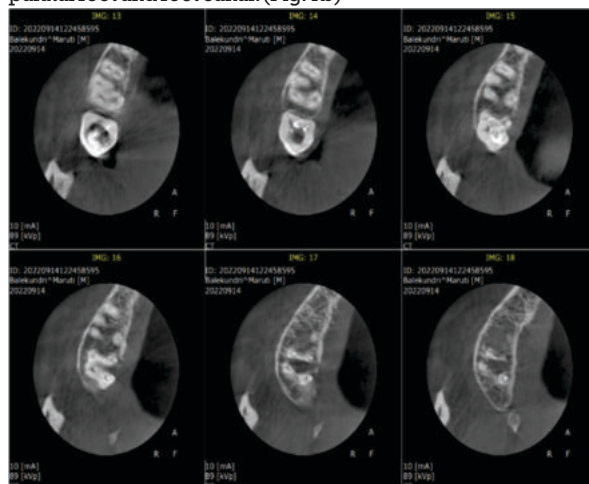
**Figure 1a: Intraoral periapical radiograph of maxillary second molar with four roots.**

**Case Report:**

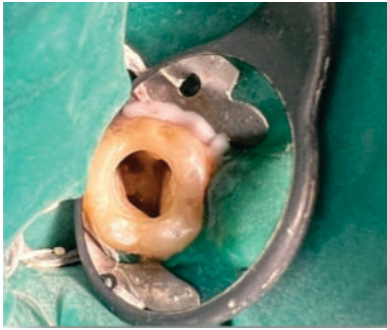
A 30-year-old male with non-contributory medical history

came to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the upper right back tooth region (Maxillary right second molar). Clinical examination and, radiographic and CBCT imaging revealed a deep carious lesion involving the pulpal space with the presence of four roots and four root canals (Fig. 1a, 1b). The tooth was non-tender on percussion. On performing vitality tests including cold, heat, and electric pulp testing the tooth elicited no response. The final diagnosis was pulpal necrosis with asymptomatic apical periodontitis and the treatment plan was root canal treatment. Informed consent was obtained from the patient to go ahead with the procedure. The tooth was anesthetized and isolated using rubber dam and an endodontic access cavity was established using an endo access bur (Dentsply Maillefer, Ballaigues, Switzerland), and the walls were refined using an endo Z bur (Dentsply Maillefer, Ballaigues, Switzerland).

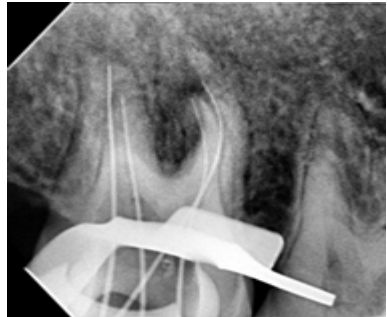
When the floor of the pulp chamber was examined using 2.5x dental loupes, four orifices of the root canals were evident clinically. (Fig. 2a) There were four roots and four root canals namely mesio-buccal root and root canal, disto-buccal root and root canal, mesio-palatal root and root canal and disto-palatal root and root canal. (Fig. 1b)



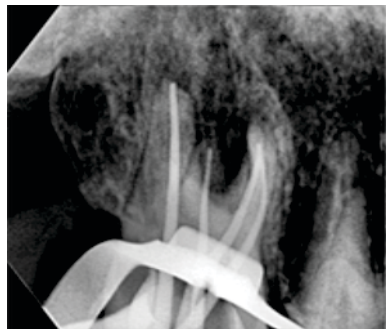
**Figure 1b: CBCT images of the maxillary arch showing axial sections at the cervical, middle and apical level showing four roots and four root canals.**



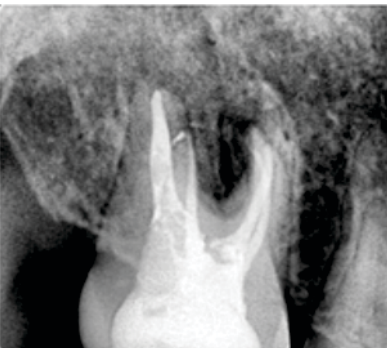
**Figure 2a: Access opening showing four orifices.**



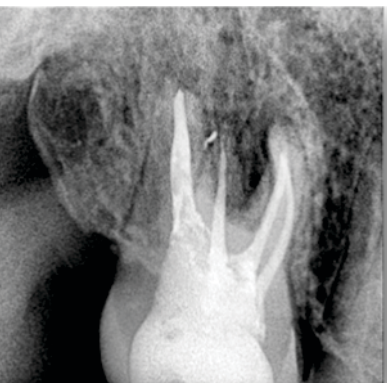
**Figure 2b: Working length determination.**



**Figure 2c: Master cone fit.**



**Figure 2d: Post-obturation**



**Figure 2e: 2 months follow-up**

Working length was established using an electronic apex locator (Root ZX mini, J. Morita Corp., Tokyo, Japan) and confirmed radiographically (Fig. 2b). Shaping and Cleaning of the root canals was performed using ProTaper Gold rotary files (Dentsply Maillefer, Ballaigues, Switzerland). Irrigation was carried out using 2.5% sodium hypochlorite and 17% EDTA. Disinfection of the root canal was carried out using calcium hydroxide (RC Cal, Prime dental products Pvt. Ltd) followed by temporization (Cavit, 3MESPE, Minnesota, USA) for the coronal seal. Following a week's recall, canals were re-entered and irrigated to remove calcium hydroxide and dried using paper points. An appropriate size of gutta percha (GP) (Dentsply Maillefer, Ballaigues, Switzerland) was selected and the fit was checked (Fig. 2c). Obturation of the root canals was carried out by using a single cone technique along with AH-Plus sealer (Dentsply DeTrey, Konstanz, Switzerland). Restoration of the tooth was carried out using composite resin (Tetric N Ceram, Ivoclar Vivadent). A final radiograph was obtained to confirm the completeness of root filling (Fig. 2d). Two months of follow-up showed the patient was asymptomatic (Fig. 2e).

**DISCUSSION**

The occurrence of four roots in maxillary second molars is a rare clinical scenario and is least documented in the literature. Christie et al. in their study reported the incidence of four separate roots and canals including two palatal roots to be about 1.4%.<sup>3</sup>

Yang et al. investigated the prevalence of two palatal roots in maxillary molars in 528 patients comprising 1957 maxillary molars using cone-beam computed tomography (CBCT). The study concluded that the prevalence of two palatal roots in the maxillary second molar is as low as 1.12%.<sup>5</sup>

Christie et al. classified four rooted maxillary second molars into 3 types based on their root configuration. Type I condition presented with two widely splayed palatal roots that are lengthy and complex. Their buccal roots are often short and convergent. Type II condition showed four short, parallel distinct roots.<sup>6</sup> Type III condition presented with a web of root dentin engaging the mesiobuccal, mesiopalatal, and distopalatal root canal.<sup>6</sup> The maxillary second molar in this case had 2 palatal roots which ran parallel to the mesiobuccal and distobuccal roots. Thus, it was classified as type II, according to Christie et al. (1991).

The use of magnification in dentistry has been continuously gaining momentum and loupes are the most popular magnification devices in use.<sup>7</sup> Dental loupes enhance vision, improve working posture, reduce treatment time, improve work quality, and increase the success rate.<sup>8,9</sup> 2.5x Dental loupes (Carl Zeiss, France) were used to locate the orifices and probable extra canals.

CBCT is a useful complement in endodontic diagnosis and allows a more accurate and predictable treatment plan design in situations of diagnostic dilemmas like developmental anomalies and root canal aberrations.<sup>10</sup> It provides a three-dimensional image reconstruction, image alteration, and analysis of the altered image.<sup>11</sup> In the present case CBCT Imaging was done to confirm the presence of four roots and root canals and to rule out the presence of any extra root canals for successful treatment outcomes.

In clinical practice extra roots and root canals can be identified by taking Angulated radiographs using instruments like the DG 16 explorer, CK 17 explorer, Micro-opener, and Path finder, performing the champagne bubble test using sodium hypochlorite, locating an extra cusp (tuberculum paramolare) in combination with a cervical prominence or convexity, widening the coronal access, using magnification in the form of dental loupes/dental operating microscope.

According to Peikoff et al. and Yang et al., the incidence of the presented case is as low as 1.4% and 1.12%, respectively signifying its rare phenomenon and clinical significance.<sup>3,10</sup>

## CONCLUSION

Knowledge of possible variations in the internal anatomy of teeth along with making the most out of advanced diagnostic aids is important to perform a successful endodontic treatment.

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