IEJ Iranian Endodontic Journal

Maxillary Second Molar with Five Root Canals and a Root-Like Enamel Pearl: A Rare Case Report

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Article Type: **Case Report**

Received: 06 Nov 2024
Accepted: 12 Dec 2024
Published: 01 Jan 2025
Doi: *10.22037/iej.v20i1.45700*

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Permanent maxillary second molars' root canal treatment due to their root configurations complexity and high root canal systems variations, are one of the most problematic teeth. Accordingly, clinicians should consider unusual canal morphology to reduce the rate of missed canals. A thirty-year-old female was referred for root canal treatment of her maxillary right second molar tooth with obvious recurrent caries under restoration and necrotic pulp. Pre-operative radiographs showed the unusual morphology and cone-beam computed tomography was ordered for precise evaluation of the root canal anatomy. The principal aim of this paper is to report a five-root canals maxillary second molar, with two palatal root canals and a palatal root-like enamel pearl canal.

Keywords: Enamel Pearl; Maxillary Second Molar; Root Canal Anatomy; Root Canal Therapy

Introduction

The primary requisite for a successful root canal treatment is to clean, shape, and obturate the entire expanse of the root canal system effectively. To achieve this objective, clinicians must become acquainted with the structural variations of each tooth [1-3]. Maxillary second molar most common configuration is three roots presence with three or four root canals, that extra canal occasionally occurs in the mesiobuccal root [4, 5]. However, rarely distobuccal and palatal root canal number variations are reported in the literature [6, 7]. Arora *et al.* [8], Ozcan *et al.* [9], and Zhao *et al.* [10] reported five canals; presenting three canals in the mesiobuccal root. Sahib *et al.*, Asghari *et al.* [11], and Nabavizadeh *et al.* [12] reported four canals in maxillary second molars that had two palatal canals. Conversely, maxillary second molars with three palatal canals, were presented only in few clinical case reports [13].

Routinely, root canal system configurations are assessed using periapical radiography before root canal treatment. Also, different angulation of preapical radiography is used to identify extra canals [14]; however, this technique in significant number of cases is inefficient to find out extra canals [15]. Therefore, according to the newest guidelines, using cone-beam computed tomography (CBCT) is recommended as a way to overcome this limitation, in cases that conventional radiography and clinical examination don't provide adequate data to do the appropriate treatment [16].

Enamel pearls are ectopic deposition of enamel, which are located at the cemento-enamel junction (CEJ) and the function area. Generally, molars are the most common teeth that they are observed in, especially maxillary molars [17]. Indeed, they have enamel small globules appearance with radio-opaque nodules that are well-defined, and firmly adherent to the tooth root surface. Internal enamel pearls have a radiodensity well-defined circular areas presentation, which extend from the enamel-dentin junction to the underlying coronal dentin [18].

This article presents a case involving the root canal treatment of a five-root canals permanent maxillary second molar with three canals in palatal, with the assistance of CBCT.

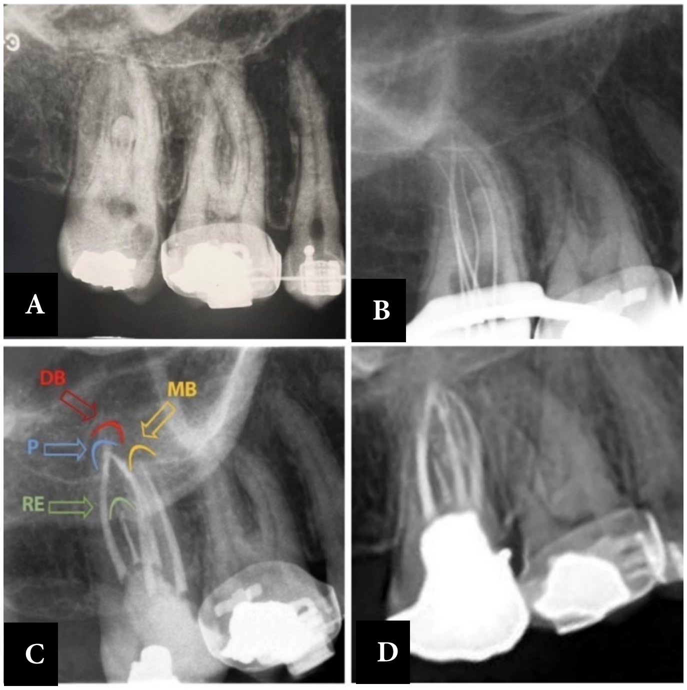

Figure 1. *A*) Initial radiograph of maxillary second molar; *B*) Working length determination radiograph with five K-files; *C*) Final obturation with demonstrating arrows (MB: Mesiobuccal, DB: Distobuccal, P: Palatal, RE: Root-like enamel pearl); *D*) One year follow up radiograph

Case presentation

A 30-year-old female patient with no systemic disease history was referred by an orthodontist to the Endodontics Department of Shiraz University of Medical Sciences for root canal treatment of the maxillary right second molar (tooth #2 in Universal Numbering System). Her orthodontic treatment was started about one year ago and clinical examination exhibited that all maxillary teeth were under orthodontic movement except maxillary second molars. Additionally, obvious recurrent caries under mesial amalgam restoration of the maxillary right second molar and radiolucency at the apex of the mesiobuccal root were seen in radiographic and clinical examinations (Figure 1A). The response of the cold test (Cold spray, Luber cool, Iran) and electrical pulp stimulation (Kerr, Analytic Technology Corp, Redmond, WA, USA) were negative. Palpation and percussion were negative; also, probing depth and mobility were within normal limits. Finally, pulp necrosis was the diagnosis, which required root canal therapy. The patient was informed about the unusual root canal morphology. After informed consent was obtained, CBCT was ordered to have a three-dimensional evaluation.

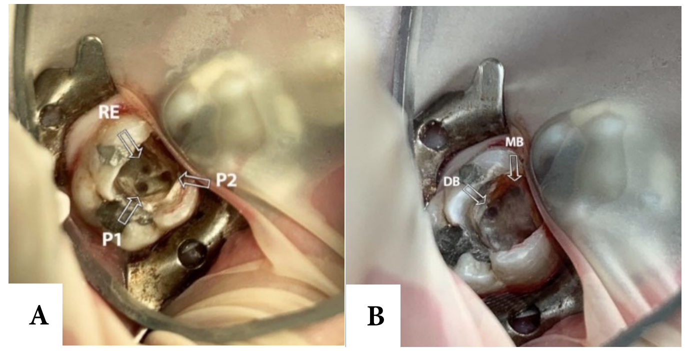

Figure 2. Access cavity with demonstrating arrows (P: Palatal, RE: Root-like enamel pearl, MB: Mesiobuccal, DB: Distobuccal)

After deep anesthesia, removal of restoration and caries was performed. Following rubber dam isolation, a conventional access opening was made using a round diamond bur (No. 4; Mani, Tochigi–Ken, Japan). The floor of pulp chamber revealed five canal orifices, two in the buccal and three in the palatal (Figure 2), which were confirmed by a limited field of view CBCT (NewTom 3G, QR Srl, Verona, Italy) with a 110 kVp tube voltage and a 7.18 mAsec tube current. Otherwise, the three palatal canals revealed two type IV canals in the Vertucci classification in palatal root and the next canal as palatal root-like enamel pearl (Figure 3) [19].

The working length was measured using #15 ISO K-files and an apex locator (Root ZX; Morita, Tokyo, Japan) and approved by conventional intraoral periapical radiography (Figure 1B).

The instrumentation was done by using NiTi rotary ProTapers (Dentsply Maillefer, Ballaigues, Switzerland). Also, continuous 5.25% sodium hypochlorite intracanal irrigation was performed with mechanical instrumentation as chemical disinfection. Then, on the same visit, the obturation was completed using gutta-percha cones and AH-26 sealer (Dentsply DeTrey; Konstanz, Germany) by cold lateral condensation technique (Figure 1C). Then, the patient was referred for permanent restoration, and to this, the access cavity was filled with the temporary filling material (Cavit; 3M ESPE, Seefeld, Germany) as the temporary restoration. The tooth remained asymptomatic and functional during the one-year follow-up period (Figure 1D).

Discussion

Failure to detect and treat additional canals remains a significant factor in unsuccessful endodontic treatments. Achieving success in endodontic treatment in teeth with an atypical number of canals requires precise diagnosis and

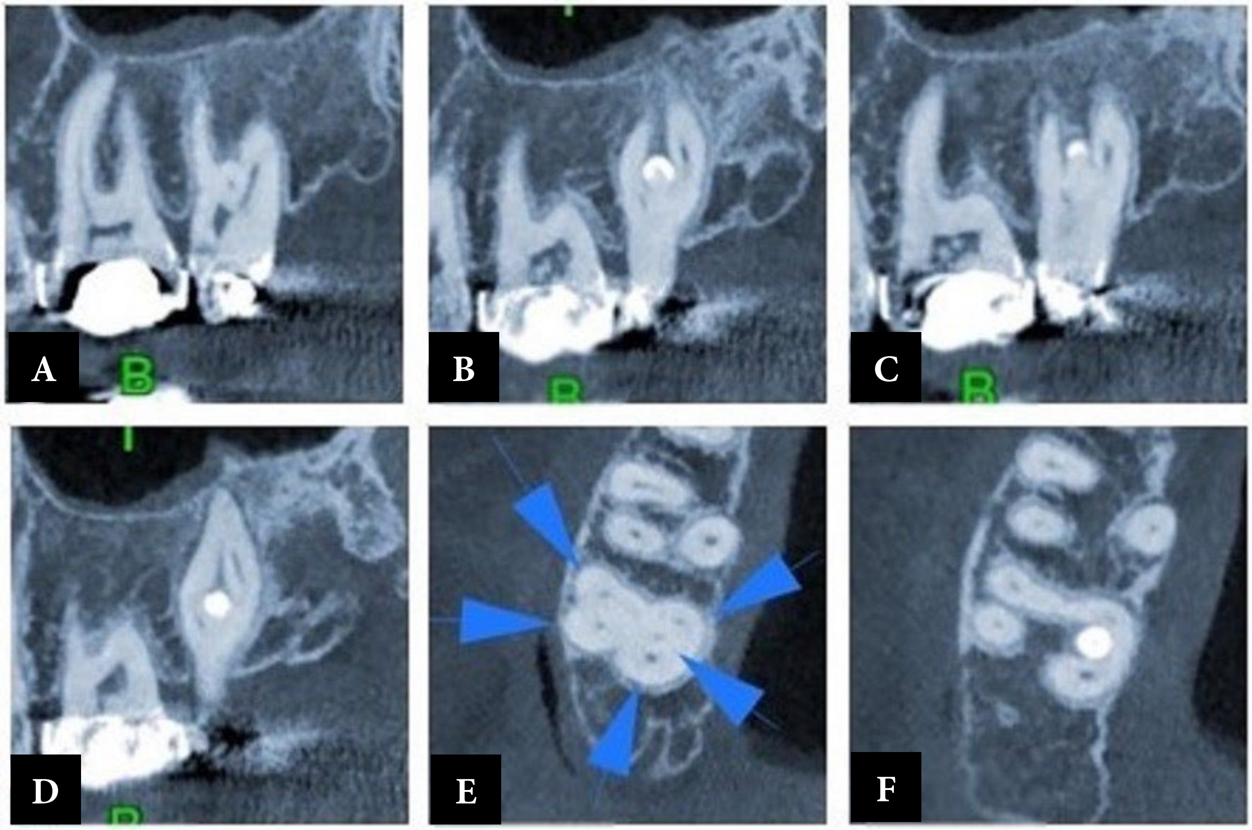

Figure 3. *A-D)* Sagittal sections of CBCT image showing small root-like enamel pearl between palatal canals; *E and F)* Axial sections determine five canals of the maxillary second molar

thorough clinical/radiographic examination [20-22]. Although the occurrence of a palatal root with multiple canals is rare, Peikoff *et al.* 's [23] study of 520 teeth revealed only a 1.4% variation with two palatal roots. A comprehensive literature search identified only two case reports (published in 2007 and 2015) showcasing a maxillary second molar with three palatal canals [6, 13]. The intricate anatomy and posterior position of these molars, coupled with superimposition on radiographs, pose challenges in detecting extra canals [13]. According to a previous study, the prognosis of teeth with more than one palatal canals was similar to that of a maxillary molar with a single canal [24].

In this case, three palatal canals revealed two canals in type IV in Vertucci classification and the next canal was a root-like enamel pearl. The enamel-dentin-pulp pearl contained a pulp horn, extended from the coronal pulp chamber [18].

In the presented case, the integration of CBCT images played a crucial role in evaluating complex root canal morphology and pinpointing extra canals, addressing a limitation of conventional 2D intraoral radiographs.

Conclusion

The possibility of extra roots, canals, and also enamel pearls should be considered by dentists in the second maxillary molars root canal treatment. While second maxillary molars anatomically vary, dentists should explore the pulp chamber floor carefully, and cases with doubtful enamel pearl should be evaluated with CBCT to prevent missed canals.

Acknowledgment
The authors thank the patient for permitting them to publish this case.

Conflict of interest
None.

Funding support
None.

Authors' contributions
Conceptualization: YG, Methodology: MZ, Formal analysis and investigation: MZ, Writing-original draft preparation: YG, Writing-review and editing: ME/SB/AA, Supervision: YG. All authors read and approved the final manuscript.

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Please cite this paper as: Zerafat M, Enteghad M, Baghaei S, Asadi A, Ghahramani Y. Maxillary Second Molar with Five Root Canals and a Root-Like Enamel Pearl: A Rare Case Report. Iran Endod J. 2025;20(1): e6. *Doi:* 10.22037/iej.v20i1.45700.