

Case Report

Endodontic management of a mandibular premolar with a concurrent occurrence of dental anomalies

Sundus Mohammed Taher Bukhary

Department of Restorative Dental Science, Division of Endodontics, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

Abstract Developmentally abnormal teeth presenting a complex root canal morphology requires special endodontic management. The present case report demonstrates successful endodontic management of a mandibular first premolar with an unusual concurrent occurrence of a double tooth and dens evaginatus with a C-shaped canal configuration in a 21-year-old patient that was diagnosed with pulpal necrosis with symptomatic apical periodontitis. In this case, the use of cone-beam computed tomography and the dental operating microscope contributed remarkably to the diagnosis and treatment of the complex root canal morphology of the anomalous tooth. Therefore, the use of recent advances in endodontics is strongly recommended in such cases to ensure predictable and successful results.

Keywords: Cone-beam computed tomography, C-shaped canal, dens evaginatus, double tooth, endodontic treatment

Address for correspondence: Dr. Sundus Mohammed Taher Bukhary, Department of Restorative Dental Science, Division of Endodontics, College of Dentistry, King Saud University, P.O. Box 45347, Riyadh 11512, Saudi Arabia.
E-mail: sbukhary@ksu.edu.sa

Submission: 26-06-20 **Revision:** 19-07-20 **Acceptance:** 25-08-20 **Web Publication:** 03-09-21

INTRODUCTION

Dental anomalies are congenital tooth malformations seen in patients with craniofacial developmental abnormalities and syndromes or present as an isolated tooth anomaly.^[1] A dental anomaly occurs if normal odontogenesis was affected due to an aberration in the interactions between the ectoderm and mesoderm during tooth bud morphodifferentiation.^[2] The occurrence of one or multiple anomalies in a tooth can occur that can affect the root/canal number, size, or shape depending on the particular stage of tooth development and can include dens evaginatus (DE), dens invaginatus (DI), the double tooth (either gemination

or fusion), concrescence, dilaceration, taurodontism, macrodontia, microdontia, and others.^[3] The incidence of dental anomalies is variable; however, the concurrent occurrence of multiple combined dental anomalies in a single tooth is rare. Few studies have reported the coexistence of dental fusion with DE,^[4,5] and DE with DI.^[6,7] Other combined occurrences of dental anomalies have been reported.^[8]

Successful endodontic treatment of the teeth with developmental anomalies depends on the identification, thorough debridement, and three-dimensional obturation of the complex morphology of the root canal system.^[9] Therefore, clinical and radiographic examination, correct

Access this article online	
Quick Response Code:	Website: www.saudiendodj.com
	DOI: 10.4103/sej.sej_164_20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Taher Bukhary SM. Endodontic management of a mandibular premolar with a concurrent occurrence of dental anomalies. *Saudi Endod J* 2021;11:400-4.

multidisciplinary diagnosis, and treatment planning are key features of successful management and long-term prognosis.^[10] Cone-beam computed tomography (CBCT) is considered one of the most significant advances in endodontics and is recommended by the American Association of Endodontics (AAE) and the American Academy of Oral and Maxillofacial Radiology (AAOMR) to be used in the endodontic management of teeth presenting dental anomalies to provide insight into the anatomic variations of the root/canal morphology.^[11] Thus, this case report presents successful endodontic management of a mandibular first premolar with an unusual occurrence of multiple dental anomalies with the aid of the CBCT scanning imaging technique.

CASE REPORT

A 21-year-old Caucasian female patient presented to the endodontic clinic complaining of mild-to-moderate pain related to the lower left posterior teeth during mastication. The patient did not have a syndrome and has no history of any systemic disease or traumatic injury and according to the American Society of Anesthesiologists (ASA) classification, she is class ASA I.

Clinical examination revealed occlusal caries in the left mandibular first premolar (#34) with a large extra cusp and abnormal crown size compared to the contralateral tooth. A sensibility test indicated no response, while a percussion test revealed mild tenderness and mild pain upon palpation. The periodontal probing showed normal depth around the tooth except a 5 mm probing depth at the distobuccal aspect of the tooth. No signs of swelling or sinus tract were associated with the tooth.

Preoperative periapical radiographic examination revealed a wide mesiodistal crown dimension with DE, fused roots with multiple root canals, and periapical and lateral radiolucency [Figure 1]. Therefore, CBCT scan was obtained to confirm root and canal numbers and morphology using a limited field of view (FOV) at a 0.075-mm voxel size, 60 kV, and 4 mA with an exposure time of 12 s using a Planmeca scanner (Planmeca ProMax; Planmeca, Helsinki, Finland). The coronal and sagittal slices confirmed the presence of DE and two fused roots with one main canal that bifurcates at the middle third of the root to the mesial and distal canals. Further evaluation of the axial slices revealed a line of fusion between the mesial and distal canals separated with an occlusal-apical groove at the lingual surface of the root with a continuous C-shaped canal configuration at the middle and apical thirds of the root. All images showed the pattern of the radiolucency

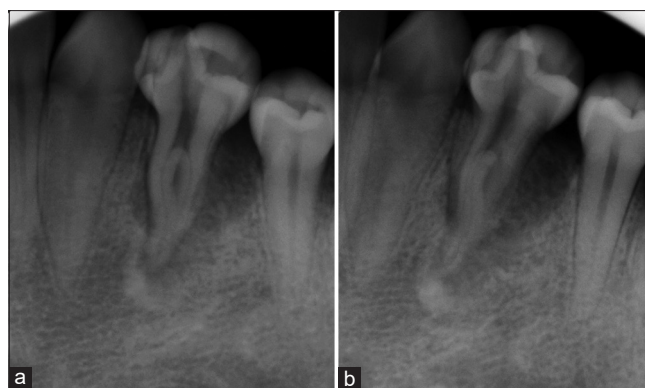


Figure 1: Preoperative periapical radiographic image of mandibular first premolar #34. (a) Straight angulation radiograph. (b) Angulated radiograph

extending along the root surfaces at the distal and lingual aspect of the root [Figure 2].

After clinical and radiographic examination, the tooth was diagnosed as pulpal necrosis with symptomatic apical periodontitis and indicated for nonsurgical endodontic treatment. Informed consent was obtained from the patient. The tooth was anesthetized with an inferior alveolar nerve block with a 1.8 mL solution of 2% lidocaine with 1:80,000 epinephrine (Lidocaine HCl, Huons Co., Seoul, Korea) then isolated with a rubber dam. Access cavity was carried out under a dental operating microscope (DOM) (ZEISS microscopy, Jena, Germany), and straight-line access was obtained using a long shank round-ended tapered diamond bur. The working length was obtained with an electrical apex locator (Root ZX II J. Morita, Tokyo, Japan) and confirmed with periapical radiography. The canals were cleaned and shaped manually using K-files up to size 20 to create a glide path and then finished with K3 Rotary files (SybronEndo, Orange, California, USA). The main canal was shaped with K3 0.04 up to size 30, whereas the mesial and distal canals were shaped up to size 25. The canals were irrigated during the cleaning and shaping with 5.25% sodium hypochlorite (20 ml). Passive ultrasonic irrigation (PUI) was applied for 1 min using an Irrisafe ultrasonic tip 25/.00 one (Acteon, Merignac, France) activated by a piezoelectric ultrasound unit Suprasson P5 Booster (Satelec Acteon, Merignac, France). The canals were dried with sterile paper points, then master gutta-percha cones were confirmed with periapical radiography [Figure 3a], obturated with the continuous wave of condensation technique (System B, Kerr Endo, USA) and thermoplasticized gutta-percha injection (Obtura II, Spartan, USA) using AH-Plus sealer (Dentsply Maillefer, Ballaigues, Switzerland) [Figure 3b]. The access cavity was sealed with composite core build-up material (MultiCore® Flow, Vivadent-Ivoclar), and the patient was referred for a full-coverage crown.

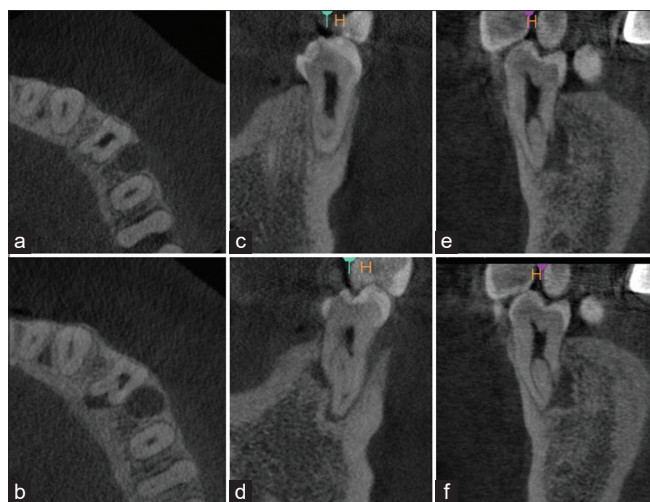


Figure 2: Cone beam computed tomography for tooth #34. (a) Axial view from the middle third showing the canal bifurcation with distal radiolucency. (b) Axial view from the apical third showing the C-shaped canal configuration with lingual and distal radiolucency. (c) Coronal view from the mesial aspect showing the low bifurcation of the main canal. (d) Coronal view from the distal aspect showing the extra fused root. (e) Sagittal view from the buccal aspect showing clearly the bifurcation of the main canal with distal radiolucency. (f) Sagittal view from the lingual aspect showing the extra canal with associated radiolucency

At the 6-month reevaluation, clinical examination revealed an asymptomatic tooth with a normal response to percussion and palpation, and the probing depth was reduced to 3 mm at the distobuccal aspect of the tooth. Periapical radiographs taken from different angulations showed a minimal reduction in the size of the periapical and lateral radiolucency, the patient was informed that further reevaluation is needed [Figure 3c].

DISCUSSION

The complex and variable root canal morphology of the teeth with dental anomalies presents a challenge for successful endodontic management.^[12] The current case presented successful endodontic management of a mandibular premolar with simultaneous occurrence of a double tooth and DE with a C-shaped canal configuration. DE is a developmental aberration of a tooth forming an accessory cusp or protuberance arising from the occlusal surface of posterior teeth or the lingual surface of anterior teeth, most commonly associated with mandibular premolars.^[13] The prevalence of DE is between 1% and 4.3%, predominantly occurs in people of Asian descent while rarely occurs in Caucasians.^[14] The projection involves a dentinal core covered with enamel and usually contains pulp tissue that extends from the pulp horn up to 3.5 mm into the dentin core of the protuberance.^[13] Pulp exposure can occur due to traumatic occlusion that leads to endodontic intervention, and thus prophylactic therapy

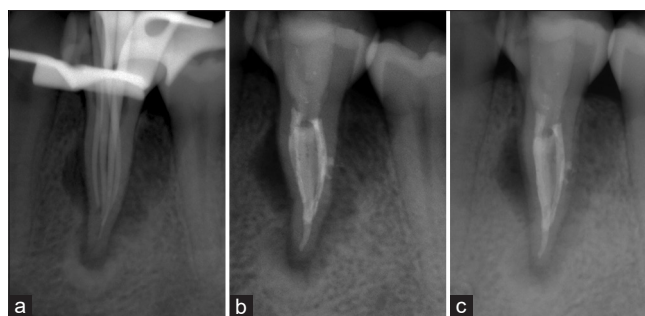


Figure 3: (a) Master cone periapical radiograph. (b) Final periapical radiograph. (c) Periapical radiograph at 6 months reveal visit

using a preventive restorative treatment is recommended for evaginated teeth.^[15] The developmental anomaly of conjoined teeth such as fusion or gemination is inherited through different etiologies. The prevalence of these anomalies has been reported to be between 0.1% and 3% in different ethnic groups, occurring predominantly in deciduous teeth and most commonly associated with incisors and canines.^[16] Gemination occurs when a single tooth germ attempts to divide, whereas fusion is a result of the union of two normally separated tooth germs, causing the formation of an enlarged clinical crown of a single tooth, with either complete joining over the full length of the teeth or only partial involvement. Fusion and gemination are difficult to distinguish when the supernumerary tooth bud is fused to the adjacent one, and therefore the term “double tooth” is used.^[17]

The occurrence of conjugated dental anomalies in a single permanent tooth has been reported to be rare. To the best of the authors' knowledge, few cases have reported successful endodontic management of combined dental anomalies in a single tooth.^[4,5] The computerized three-dimensional reconstruction of the double tooth showed a very complex and unusual internal and external root anatomy, which is considered an endodontic challenge.^[18] Therefore, comprehensive clinical and radiographic evaluation of anomalous teeth is a prerequisite before initiating endodontic therapy. The importance of utilizing the CBCT imaging modality is stressed in cases of suspected complex morphological variations.^[19] The AAE and AAOMR recommended the use of a limited FOV that is capable of providing images with high diagnostic quality in short scanning times and low dosages and can also provide three-dimensional reconstruction imaging.^[11] In the present case, CBCT imaging was obtained before initiating the treatment for morphological analysis. The sagittal, coronal, and axial CBCT images showed bizarre anatomy of the fused roots that had a deep radicular groove located on the external lingual surface of the root that divided the main canal, forming a C-shape.

The challenge of successfully treating the C-shaped canal configuration requires meticulous mechanical and chemical debridement of the root canal system, which might include isthmus, fins, and root canals merging. The prevalence of C-shaped root canal morphology in mandibular first premolars is reported to range from 1.1% to 18% and varies greatly among ethnic groups.^[20] The pulp chamber of a C-shaped root canal system has low bifurcation and thin dentin around the narrow isthmus, which should be taken in consideration during negotiating and preparing the canals to avoid weakening or perforating the dentinal walls.^[21] The C-shaped root canal configuration of mandibular premolars has been characterized by Fan *et al.* as a cross-sectional root canal system presenting a continuous “C” without division (Type C1) or resembling a semicolon resulting from a discontinuous “C” (type C2).^[22] In this case, the root canal morphology would fall into type C1. The effective debridement and removal of infected pulpal tissues from C-shaped canal irregularities and isthmuses depend on the direct access of irrigants to these regions.^[23] PUI using noncutting ultrasonically activated files forms powerful acoustic streaming that can disrupt the vapor lock and exchange the irrigants in apical and hard-to-reach areas.^[24] Several previous studies reported the debridement efficacy of sodium hypochlorite combined with PUI in the isthmus and 1–3 mm apical region in mandibular molars.^[25,26] In this report, PUI was used for 1 min with 5.25% sodium hypochlorite to improve the permeability of the irrigant through the complex root canal morphology. Furthermore, the canals were obturated with warm vertical compaction using the continuous wave condensation technique, as this technique is more adaptable to the isthmus and canal ramifications compared to other filling techniques.^[27,28]

The use of DOM will enhance visualization and improve the clinical performance of such challenging cases by the means of magnifications and appropriate lighting provided by the DOM. The effective use of DOM was reported by several authors in the endodontic management of complex anatomical variations.^[29,30] In the present case, the DOM was used which enhanced the exploration of the floor of the pulp chamber and aid in locating and negotiating the C-shaped canal configuration orifices. Moreover, it facilitated the process of cleaning and shaping and filling the complex root canal system.

CONCLUSION

In the present case, successful nonsurgical endodontic treatment of a mandibular premolar with multiple dental anomalies was performed supported by the use of CBCT imaging. The use of CBCT for comprehensive

morphological analysis, illumination, and magnification for proper access preparation, pulpal floor inspection, and visualization aid during root canal system debridement and obturation is strongly emphasized for a successful treatment outcome.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Elsten EE, Caron CJ, Dunaway DJ, Padwa BL, Forrest C, Koudstaal MJ. Dental anomalies in craniofacial microsomia: A systematic review. *Orthod Craniofac Res* 2020;23:16-26.
2. Peterkova R, Hovorakova M, Peterka M, Lesot H. Three-dimensional analysis of the early development of the dentition. *Aust Dent J* 2014;59:55-80.
3. Vastardis H. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. *Am J Orthod Dentofacial Orthop* 2000;117:650-6.
4. Taloumis IJ, Nishimura RS Jr. Treatment of an unusual instance of fusion with a talon cusp. *Gen Dent* 1989;37:208-10.
5. Shah N, Jadhav GR, Mittal P, Logani A. Conservative management of dens evaginatus and attached supernumerary tooth/odontome in mandibular premolar with dual radiolucencies. *Contemp Clin Dent* 2015;6 Suppl 1:S269-S73.
6. Anthonappa RP, Yiu CK, King NM. A novel combination of dens evaginatus and dens invaginatus in a single tooth--review of the literature and a case report. *J Clin Pediatr Dent* 2008;32:239-42.
7. Lwin HN, Kyaw PP, Thu SW. Coexistence of true talon cusp and double dens invaginatus in a single tooth: A rare case report and review of the literature. *Clin Case Rep* 2017;5:2017-21.
8. Tikku A, Nadkarni UM, Damle SG. Management of two unusual cases of dens invaginatus and talon cusp associated with other dental anomalies. *Int J Paediatr Dent* 2007;17:178-85.
9. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. *Endod Topics* 2005;10:3-29.
10. Friedman S, Mor C. The success of endodontic therapy--healing and functionality. *J Calif Dent Assoc* 2004;32:493-503.
11. Fayad MI, Nair M, Levin MD, Benavides E, Rubinstein RA, Barghan S, *et al.* AAE and AAOMR joint position statement: Use of cone beam computed tomography in endodontics 2015 update. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2015;120:508-12.
12. Ahmed HM, Dummer PM. A new system for classifying tooth, root and canal anomalies. *Int Endod J* 2018;51:389-404.
13. Levitan ME, Himel VT. Dens evaginatus: Literature review, pathophysiology, and comprehensive treatment regimen. *J Endod* 2006;32:1-9.
14. Lin CS, Llacer-Martinez M, Sheth CC, Jovani-Sancho M, Biedma BM.

Bukhary: Endodontic management of a mandibular premolar with a concurrent occurrence of dental anomalies: A case report

- Prevalence of premolars with dens evaginatus in a Taiwanese and Spanish population and related complications of the fracture of its tubercle. *Eur Endod J* 2018;3:118-22.
15. Chen RS. Conservative management of dens evaginatus. *J Endod* 1984;10:253-7.
16. Lochib S, Indushekar KR, Saraf BG, Sheoran N, Sardana D. Occlusal characteristics and prevalence of associated dental anomalies in the primary dentition. *J Epidemiol Glob Health* 2015;5:151-7.
17. Méndez P, Junquera L, Gallego L. Double teeth. *Br Dent J* 2007;202:508-9.
18. Lyrroudia K, Mikrogeorgis G, Nikopoulos N, Samakovitis G, Molyvdas I, Pitas I. Computerized 3-D reconstruction of two “double teeth”. *Endod Dent Traumatol* 1997;13:218-22.
19. Cotton TP, Geisler TM, Holden DT, Schwartz SA, Schindler WG. Endodontic applications of cone-beam volumetric tomography. *J Endod* 2007;33:1121-32.
20. Martins JN, Francisco H, Ordinola-Zapata R. Prevalence of C-shaped configurations in the mandibular first and second premolars: A cone-beam computed tomographic *in vivo* study. *J Endod* 2017;43:890-5.
21. Fan B, Cheung GS, Fan M, Gutmann JL, Fan W. C-shaped canal system in mandibular second molars: Part II: Radiographic features. *J Endod* 2004;30:904-8.
22. Fan B, Yang J, Gutmann JL, Fan M. Root canal systems in mandibular first premolars with C-shaped root configurations. Part I: Microcomputed tomography mapping of the radicular groove and associated root canal cross-sections. *J Endod* 2008;34:1337-41.
23. Siqueira JF Jr., Araújo MC, Garcia PF, Fraga RC, Dantas CJ. Histological evaluation of the effectiveness of five instrumentation techniques for cleaning the apical third of root canals. *J Endod* 1997;23:499-502.
24. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. Review of contemporary irrigation agitation techniques and devices. *J Endod* 2009;35:791-804.
25. Virdee SS, Seymour DW, Farnell D, Bhamra G, Bhakta S. Efficacy of irrigant activation techniques in removing intracanal smear layer and debris from mature permanent teeth: A systematic review and meta-analysis. *Int Endod J* 2018;51:605-21.
26. Al-Mahdi AA, Balto HA. The synergistic effect of ultrasonic activation and irrigation on *Enterococcus faecalis* biofilm. *Saudi Endod J* 2016;6:1-8.
27. Lea CS, Apicella MJ, Mines P, Yancich PP, Parker MH. Comparison of the obturation density of cold lateral compaction versus warm vertical compaction using the continuous wave of condensation technique. *J Endod* 2005;31:37-9.
28. Barbosa FO, Gusman H, Pimenta de Araújo MC. A comparative study on the frequency, location, and direction of accessory canals filled with the hydraulic vertical condensation and continuous wave of condensation techniques. *J Endod* 2009;35:397-400.
29. Al-Mahroos SA, Al-Sharif AA, Ahmad IA. Mandibular premolars with unusual root canal configuration: A report of two cases. *Saudi Endod J* 2016;6:87-91.
30. Al-Dahman YH, Al-Qahtani SA, Al-Mahdi AA, Al-Hawwas AY. Endodontic management of mandibular premolars with three root canals: Case series. *Saudi Endod J* 2018;8:133-8.