Antonio Bertó Botella, Rafael Miñana Laliga, Gerald N Glickman, James L Gutmann

# Diagnosis and root management of a two-rooted maxillary central incisor

**Antonio Bertó Botella, DDS**
Baylor College of Dentistry, Dallas, TX, USA

**Rafael Miñana Laliga, DDS**
University of Valencia, Valencia, Spain

**Gerald N Glickman, DDS, MS**
Baylor College of Dentistry, Texas A&M University, Dallas, TX, USA

**James L Gutmann, DDS, PhD, FACD, FICD, FADI**
Baylor College of Dentistry, Texas A&M University, Dallas, TX, USA

**Correspondence to:**
Dr Antonio Bertó Botella
Baylor College of Dentistry, Texas A&M University, 3001 Sale St #316, Dallas, TX 75219, USA
Tel: 214-457-9281
Email: bertoendodontics@gmail.com

**Key words** *anatomical variation, diagnosis, maxillary central incisor, multi-rooted tooth, root canal treatment*

A 15-year-old female presented for root canal treatment of a symptomatic left maxillary central incisor. Although the internal anatomy of the maxillary central incisor is well known and usually presents with one root and a relatively simple root canal system, a second root with a separate root canal was located, treated and the patient's symptoms were eliminated. The purpose of this case report is to describe the diagnosis and root canal treatment of a maxillary central incisor with two roots and two canals.

## Introduction

Successful root canal treatment of teeth is dependent upon cleaning, shaping and disinfection of the root canal system as thoroughly as possible and filling it in all dimensions[1]. Most clinicians consider the maxillary central incisors as having the simplest root system to accomplish these goals. Vertucci reported that 100% of central incisors have only one canal (Type I)[2]. But as with other teeth, it is possible to see variations. Some investigators have reported different maxillary central incisors with two canals[3-7]. In this article, the identification and diagnosis of a maxillary central incisor with two canals that required root canal treatment is described.

## Case report

A 15-year-old Hispanic female was referred to the Graduate Endodontic Clinic of Baylor College of Dentistry, Dallas, Texas, for root canal treatment of the left maxillary central incisor (tooth 21). The patient had a non-contributory medical history, no known allergies and was classified as an ASA I, which corresponds to a normal healthy patient according to American Society of Anesthesiologists. This system is a six-category physical status classification that assesses the fitness of patients prior to treatment procedures and is being applied on a regular basis throughout the dental community in the United States[8]. The patient's chief complaint was that she 'had a bump in her gums'.

**Fig 1** Clinical picture showing the presence of a sinus tract over the apex of tooth 21.

The patient reported she had suffered a traumatic injury 2 years previously that was treated at the Pediatric Department at the Baylor College of Dentistry. The clinical appearance of this tooth showed an extensive composite resin restoration. Subjectively, the patient was experiencing pain on biting and pressure in the tissues above the maxillary left central incisor. Objectively, no caries were detected, and there was a sinus tract present (Fig 1). When traced with a gutta-percha cone, it pointed to the maxillary left central incisor (Fig 2). This tooth gave no response to electric pulp test (EPT) (Analytic Pulp Tester; SybronEndo, Orange, CA, USA) and cold (Endo-Ice; Coltène/Whaledent, Cuyahoga Falls, OH, USA). When compared to control teeth, this tooth was painful to percussion. A diagnostic radiograph revealed a radiolucency around the apex of this tooth (Fig 3). Probing depths around the tooth were less than 3 mm, and no unusual mobility was detected. After the pulp sensibility tests and radiographic examination, the tooth was diagnosed as having a necrotic pulp with a chronic apical abscess and draining sinus tract.

Following anaesthesia with 1.8 ml of 2% lidocaine with 1:10000 epinephrine (Xylocaine with epinephrine; Astra Pharmaceutical Products, Westborough, MA, USA), a dental dam was placed and an access cavity was prepared followed by negotiation of the root canal. A colour change was noticed in the canal's mesial wall during the chemomechanical preparation of the main canal. Exploration of this site with a size 08 stainless steel K-file (Dentsply-Maillefer, Ballaigues, Switzerland) revealed a second orifice in the middle third of the root, approximately 11 mm apical to the incisal edge. The second canal

**Fig 2** Sinus tract traced pointing to the apex of tooth 21.

opened at a 45 degree angle from the main canal and coursed mesially, staying separated from the main canal for its entire length. With the aid of a surgical endodontic microscope, a size 10 stainless steel K-file (Dentsply-Maillefer) with an accentuated curved tip was used to find the location of the canal separation, followed by a size 15 K-file to negotiate the second canal (Figs 4 to 6). A working film was exposed to confirm the existence of a canal and to differentiate this from either a perforation or fracture. The working film confirmed a second root canal that separated from the first canal at a severe angle. In order to prepare straight-line access to this canal, removal of the dentine bulge was carried out with Gates Glidden drills #3 and #4 (Dentsply-Maillefer) until the orifice of the second canal, which was 11 mm under the reference point, was more easily identified and accessible. Subsequently, the final root canal measurement was determined and the canals were cleaned and shaped using a crown-down technique with copious irrigation (NaOCl 6%) and using the ProFile® Vortex™ file system (Dentsply-Tulsa Dental Specialties, Tulsa, OK, USA) to a 0.04 taper size 35 file for the accessory canal, and a 0.06

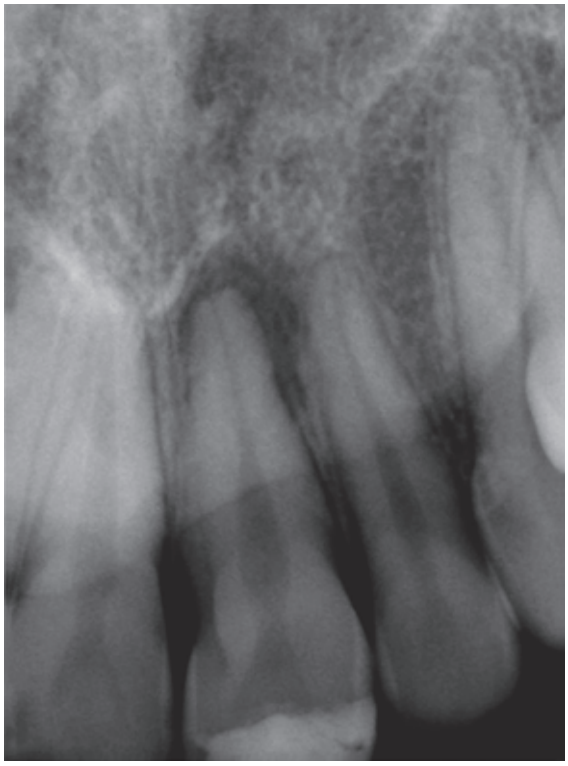


**Fig 3** Preoperative radiograph. An unusual root anatomy can be noticed.

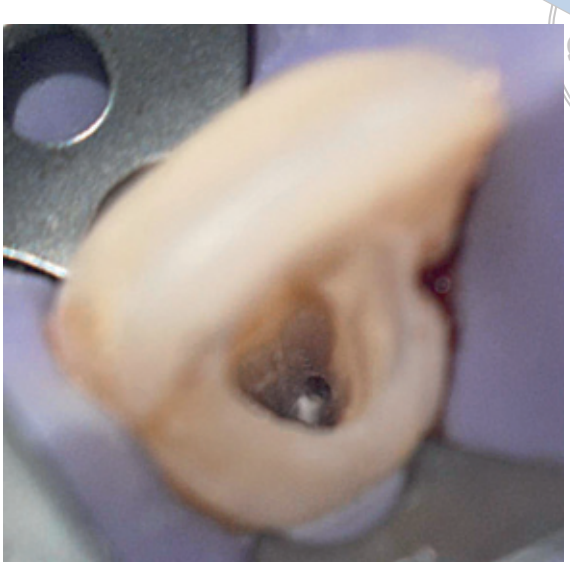


**Fig 4** Clinical picture showing the location of an accessory canal.

taper size 50 file for the main canal system. Following a final irrigation with 10 ml NaOCl (6%), 6 ml EDTA (17%) and 2% chlorhexidine as final rinse, the canals were dried with paper points and filled with calcium hydroxide paste (UltraCal XS; UltraDent, South Jordan, UT, USA) using a NaviTip 31 g 27 mm Sideport 50PK (Green) (UltraCal XS; UltraDent). The access cavity was filled with 4 mm of IRM cement (Dentsply Caulk, Milford, DE, USA).

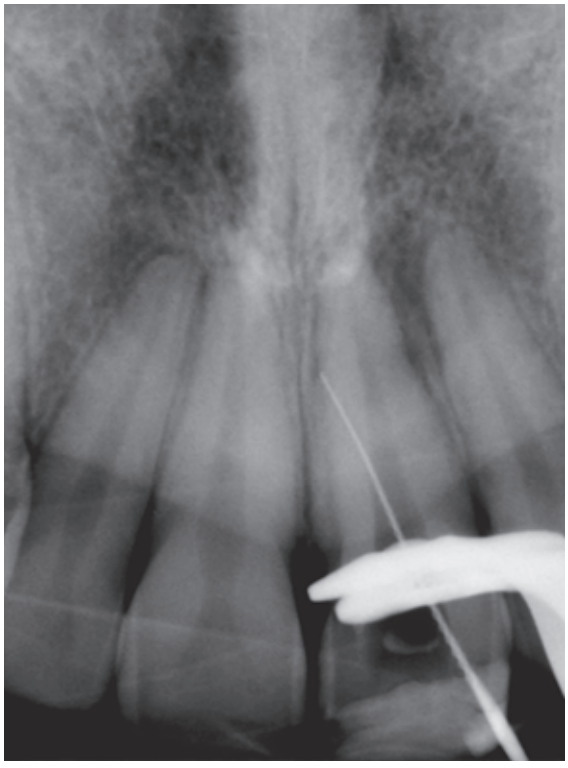


**Fig 5** Radiograph showing the presence of a 2nd canal at mid third root.

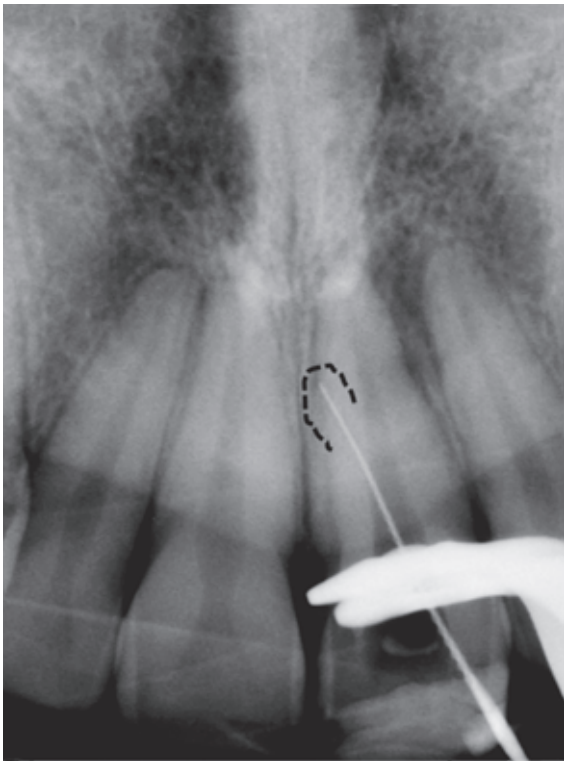


**Fig 6** Same as Figure 5 but with dots outlining the profile of the extra root.

**Fig 7** Clinical picture showing sinus tract healed 2 weeks after initial treatment.

At a second visit 14 days later, the sinus tract was healed, and clinical symptoms had subsided (Fig 7). The canals were rinsed with 6% NaOCl, and were cleaned briefly with files to remove loose calcium hydroxide remnants. After final canal preparation and irrigation as described previously, the canals were dried with paper points and filled with Resilon™ and RealSeal™ sealer (SybronEndo) using a warm vertical compaction technique. The access cavity was again sealed with 4 mm of IRM cement (Fig 8).

The permanent filling was placed 1 week later using a composite resin (Z250; 3M ESPE, St Paul, MN, USA). A radiograph was taken to ensure control of the filling. A 3-month recall radiograph showed initial bony healing (Figs 9 and 10). Clinical examination showed no sensitivity to percussion or palpation, and the soft tissues were healthy.

**Fig 8** Postoperative radiograph.

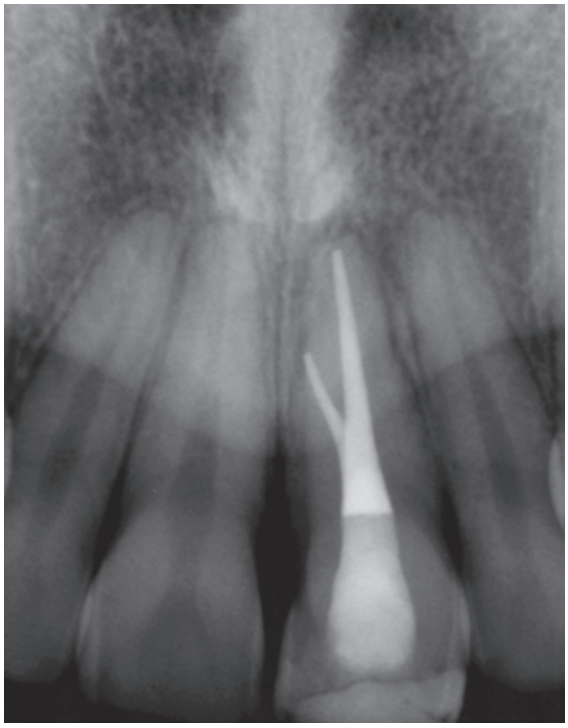
## Discussion

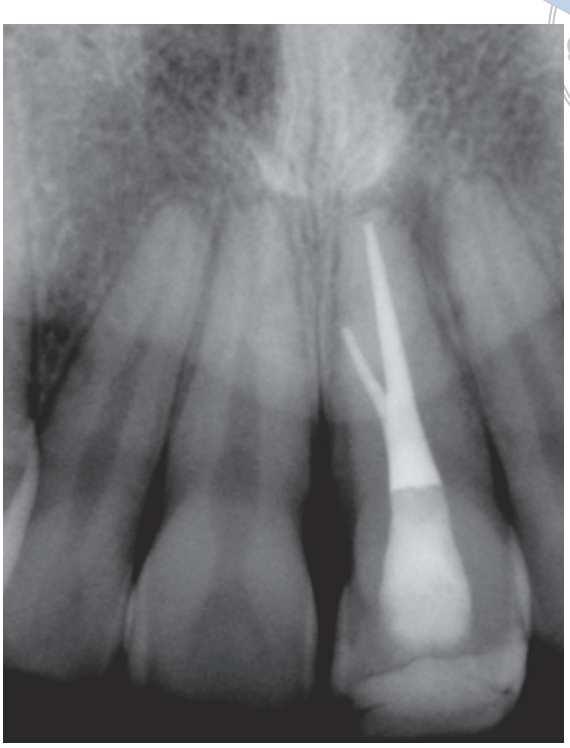
When performing root canal treatment, the clinician must always be prepared for unexpected root canal morphology. Finding more than one canal in maxillary central and lateral incisors is rare. In fact, according to the literature[2], 100% of these teeth show single canals. The description of multiple canals in maxillary incisors is generally limited to case reports of anomalies identified as fusion, gemination or dens invaginatus[9-12].

There are few cases of maxillary central incisors with two canals reported in the literature[3,6,7] and most of them present morphological alterations, such as macrodontia and fusion[6]. However root canal treatment of a maxillary central incisor with a normal clinical crown and two root canals, one buccal and one lingual, has been reported previously[3,7].

The aetiology behind the formation of the extra root is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence). In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in more pronounced phenotypic manifestation[13,14]. Curzon, when studying the incidence of three-rooted mandibular molars, suggested that the 'three-rooted molar' trait has a high degree of genetic penetrance as its dominance was reflected in the fact that the prevalence of the trait was similar in both pure Eskimo and Eskimo/Caucasian mixes[15].

Careful radiographic evaluation may lead to identification or suspicion of additional root canals[16]. Maxillary incisors with second canals or roots may also have lingual grooves. By being aware of developmental anomalies and carefully evaluating the diagnostic radiograph, the clinician can be better prepared to locate and treat unexpected additional canals.





**Figs 9 and 10** 3-month recall radiographs showed initial bony healing.

The lack of knowledge about all possible root canal anatomical configurations and the non-use of different diagnostic resources can lead dentists to leave remaining necrotic tissue and toxic products used during root canal procedures in the interior of the untreated canal, resulting in an unsuccessful outcome. Thus, this case report not only emphasises the clinical management of this aberrant root system, but also highlights the need for good radiographic technique and assessment. To further enhance this goal, when possible the use of cone-beam computerised tomography may aid the clinician in identifying teeth with abnormal root anatomy[17].

## References


1. Cohen S. Burns RC. Pathways of the Pulp, ed 9. St. Louis, MO: Mosby, 2006: 149.
2. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-599.
3. Genovese FR, Marsico EM. Maxillary central incisor with two roots: a case report. J Endod 2003;29:220-221.
4. Sinai IH, Lustbader S. A dual-rooted maxillary central incisor. J Endod 1984;10:105-106.
5. Lambruschini GM, Camps J. A two rooted maxillary central incisor with a normal clinical crown. J Endod 1993;19:95-96.
6. Cimilli H, Kartal N. Endodontic treatment of unusual central incisors. J Endod 2002;28:480-481.
7. Ghoddusi J, Zarei M, Vatanpour M. Endodontic treatment of maxillary central incisor with two roots - a case report. NY State Dent J 2007;73:46-47.
8. Maloney WJ, Weinberg MA. Implementation of the American Society of Anesthesiologists: physical status classification system in periodontal practice. J Periodontol 2008;79:1124-1126.
9. Mangani F, Ruddle CJ. Endodontic treatment of a "very particular" maxillary central incisor. J Endod 1994;20: 560-561.
10. Beltes P. Endodontic treatment in three cases of dens invaginatus. J Endod 1997;23:399-402.
11. Hülsmann M. Dens invaginatus: aetiology, classification, prevalence, diagnosis, and treatment considerations. Int Endod J 1997;30:79-90.
12. Walvekar SV, Behbehani JM. Three root canals and dens formation in a maxillary lateral incisor: a case report. J Endod 1997;23:185-186.
13. Reichart PA, Metah D. Three-rooted permanent mandibular first molars in the Thai community. Dent Oral Epidemiol 1981;9:191-192.
14. Ribeiro FC, Consolaro A. Importancia clínica y antropológica de la raíz distolingual en los molars inferiores permanentes. Endodoncia 1997;15:72-78.
15. Curzon ME. Miscegenation and the prevalence of three-rooted mandibular first molars in the Baffin Eskimo. Community Dent Oral Epidemiol 1974;2:130-131.
16. Slowey R. Radiographic aids in the detection of extra root canals. Oral Surg Oral Med Oral Pathol 1974;37:762-772.
17. Patel S, Dawood A, Pitt Ford T, Whaites E. The potential applications of cone beam computed tomography in the management of endodontic problems. Int Endod J 2007;40:818-830.