

CASE REPORT

Endodontic treatment of mandibular incisors with two root canals: Report of two cases

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Abstract

The root canal anatomy of mandibular incisors can present a number of variations, including multiple canals. Two case reports are presented to illustrate the serendipitous discovery and successful non-surgical endodontic management of complex canal systems in mandibular incisors. In both cases, all four mandibular incisors had two canals each.

Introduction

The morphology of mandibular central and lateral incisors is very similar. The root canal systems of these single-rooted teeth often have three pulp horns and a single root canal, but some studies (see below) have demonstrated that the root canal anatomy of mandibular incisors is not as simple as it may appear to be on standard periapical radiographs, and that it may be complicated by the presence of bifurcated and lateral canals. The bifurcation of a root canal is the position at which a single canal splits into two smaller canals that follow divergent pathways; in some cases, these canals may rejoin to form a single canal again. Lateral canals are canals that emanate from the main canal but take a perpendicular course to exit into periodontal ligament space. As reported, more than 40% of mandibular incisors have two canals and more than 1% has two separate apical foramina (1). According to another study, 15% of the teeth studied showed a bifurcated canal, 7.7% had a lateral canal, and 25% had an accessory canal, which was defined as a secondary canal that emanated from the main canal and travelled at an angle alongside it before exiting into the periodontal ligament space (2). After examining 1085 transparent specimens of extracted mandibular incisors, Migashita *et al.* reported that more than 85% of those teeth possessed a single canal (3). They also reported that 3% of the specimens with furcations possessed two separate canals (3). Benjamin and Dowson found that of their total sample of 364 mandibular incisors, 151 (41.4%) had two separate

canals when examined clinically; that is, the probe could be inserted only in a single direction labially and in another direction lingually, but not between the two (4). It is thus generally agreed that the presence of two root canals within single-rooted permanent mandibular incisors is the rule, not the exception. Many of the second, accessory and lateral canals are detected only by means of a stereomicroscope after the teeth have been extracted, decalcified and cleared. Most of them are very small and cannot be identified *in vivo* during endodontic treatment or on periapical radiographs.

Funato *et al.* reported a case of a mandibular central incisor with two root canals and two separate apical foramina (5). The tooth showed inadequate endodontic treatment and a periapical radiolucent lesion. This case demonstrated that a good understanding of the anatomy of the root canal system is an essential prerequisite for successful root canal treatment (6–8). Failure by the operator to recognise the anatomy of a root canal system as well as the possible developmental anomalies and their consequences might lead to inadequate debridement of the root canal system which, in turn, may contribute to unfavourable endodontic treatment outcomes and the subsequent need for endodontic retreatment or surgical intervention.

The purposes of this case report are to illustrate the outcome of endodontic treatment of two patients who had two separate root canals in all four of their mandibular incisors, and to discuss the signs suggesting the presence of second canals in mandibular incisors.

Case report 1

A 65-year-old man presented to the Department of Restorative Dentistry of the Belarusian State Medical University after being referred by a prosthodontist. The patient had not experienced any symptoms and was seeking endodontic treatment of the mandibular incisors before having metal-ceramic crowns placed to restore these teeth as they had marked abrasion of the incisal edges and in the cervical regions. There had been gingival and bone recession of at least 2 mm from the cemento-enamel junction, but no deep periodontal pockets were detected. There was a slight reaction to cold air and water applied to the cervical regions of the mandibular central incisors. A preoperative panoramic radiograph showed no signs of these teeth having two root canals.

Non-surgical endodontic treatment was planned with exploration, cleaning, shaping and filling of the root canal

systems of two teeth per appointment while anaesthetised with an infiltration injection of 1.0 mL of Ultracain DS (Aventis Pharma, France). At the first appointment, the right central and lateral mandibular incisors were isolated with a rubber dam (Hygenic corp, Akron, OH, USA) and access cavities were prepared. The pulp chamber of the central incisor was noted as having an unusually large size and a second root canal orifice was found in the labial portion of the pulp chamber. Similarly, the lateral incisor had two root canals (labial and lingual). Chemomechanical debridement of the canals was completed using a combination of K-files and Gates-Glidden drills (Dentsply-Maillefer, Ballaigues, Switzerland) while irrigating with 3% sodium hypochlorite and 17% EDTA gel. The root canals were then filled with gutta-percha using the lateral condensation method and Apexit (VOCO GmbH, Cuxhaven, Germany) as the sealer (Fig. 1a). The access cavities were temporarily restored with glass ionomer cement.

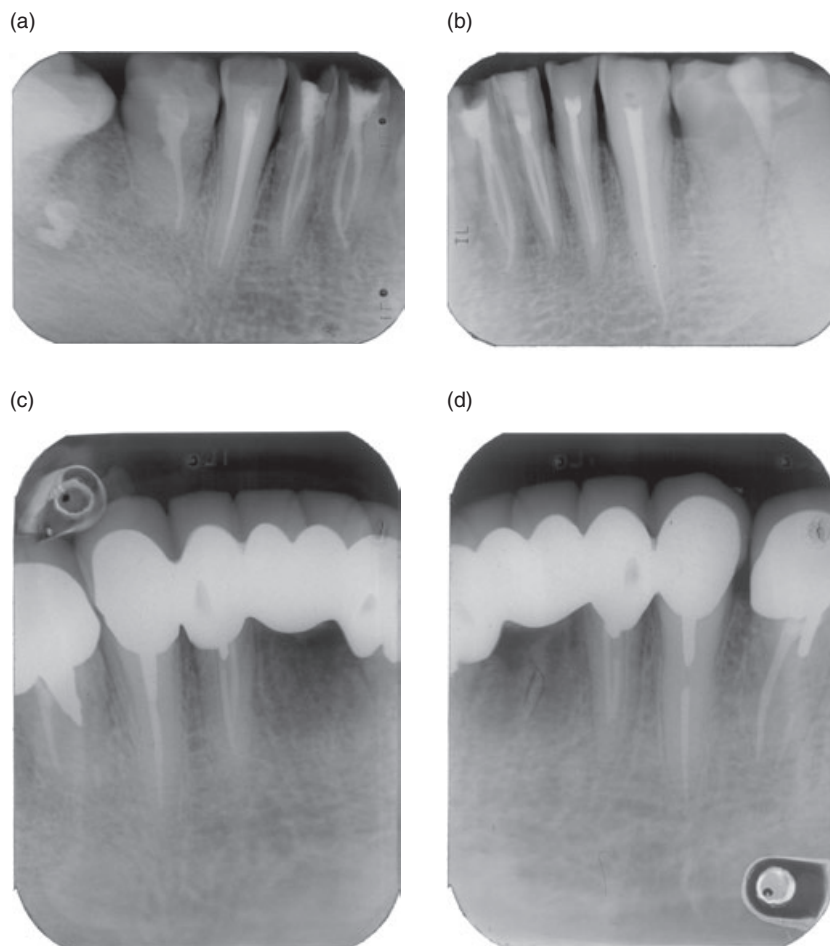


Figure 1 Case report 1. (a) Postoperative periapical radiograph following endodontic treatment of the mandibular right central and lateral incisors. (b) Postoperative periapical radiograph following endodontic treatment of the mandibular left central and lateral incisors. (c) 14-month review radiograph of the mandibular right central and lateral incisors. (d) 14-month review radiograph of the mandibular left lateral incisor.

At the next appointment, the mandibular left central and lateral incisors were anaesthetised and isolated with a rubber dam. Access cavities were prepared and the pulp chambers were also noted to be unusually large in both teeth. Labial and lingual canals were found in both teeth and they were then chemomechanically debrided and filled as described previously (Fig. 1b).

The patient reported no symptoms following the endodontic treatment and he was then referred back to the prosthodontist for restoration of these teeth with cast metal posts and metal ceramic crowns. However, unfortunately, the mandibular right central incisor had to be extracted because of a vertical fracture that occurred during preparation for the post/core restoration. It was replaced with a bridge in conjunction with restoration of the other mandibular incisors. At a review appointment 14 months later, the patient reported no complaints and there were no clinical or radiographic signs of periapical inflammation (Fig. 1c,d).

Case report 2

A 45-year-old woman presented to the Department of Restorative Dentistry of the Belarusian State Medical University after being referred by her general dentist for endodontic treatment of the mandibular right lateral incisor that had a pulpless, infected root canal system and chronic apical periodontitis. The treatment had been commenced by the general dentist; but he had noticed an unusual shape of the root on the preoperative periapical radiograph and therefore referred to the patient to the university clinic for specialist management.

The patient had not experienced any clinical symptoms, but there was a periapical radiolucency (approximately 3 mm in diameter) associated with the mandibular right lateral incisor. The preoperative radiograph also indicated that both the mandibular right central and lateral incisors had two canals each (Fig. 2a).

The tooth was treated over two appointments – during the first appointment, the tooth was anaesthetised and the canals were prepared in the same manner as described before. Calcium hydroxide was placed in the canals as an inter-appointment antibacterial medicament. During the second appointment, the root canals were filled with laterally condensed gutta-percha and Apexit sealer (Fig. 2b). The patient was then referred back to her general dentist, who restored the tooth with a cast metal post and a plastic crown. Twelve months later, there were no clinical signs or symptoms associated with the tooth and the periapical radiolucency had considerably reduced in size (Fig. 2c).

Fourteen months later, the patient presented to the clinic with symptoms indicating irreversible pulpitis in the

two mandibular central incisors. These teeth were endodontically treated in one appointment using the same techniques and materials described previously. The access cavities were filled with glass ionomer cement and metal-ceramic restorations were recommended. Both mandibular central incisors had two canals each and radiographs also indicated that the untreated mandibular left lateral incisor had also two canals (Fig. 2d).

Discussion

The two patients presented in this report had two root canals in all of their mandibular incisors (i.e. in four teeth simultaneously). It is likely that this occurrence of four mandibular incisor teeth in the same patient with two canals each is reported in the literature for the first time.

Dental anomalies are often observed in patients with genetic syndromes; for example, the most frequent dental deformities in patients with Turner's syndrome are two-rooted mandibular premolars whereas such premolars occurred very rarely in their control group of people without this syndrome (1% of cases) (9). However, in the two cases presented in this current report, neither patient had any external signs of chromosomal disorders. Their relatives, who were also examined by staff at the same University clinic, had only a single root canal in their mandibular incisors. Hence, genetic factors can be ruled out as a cause of their unusual anatomy.

These cases illustrate some of the difficulties that may arise during root canal treatment. The main reason for unfavourable outcomes in endodontic treatment of mandibular incisors is the inability to detect the presence of a second canal, which then will not be disinfected and filled during treatment (10).

It is essential that clinicians know the clinical and radiographic signs that suggest the presence of extra canals. Clinically, the presence of continuous bleeding in teeth with pulpitis or normal pulps despite complete instrumentation can suggest the presence of such canals (8). In cases with necrotic pulps or when the canals are pulpless, the presence of an apical rarefaction on the lateral side of the root may suggest the presence of an extra canal. Some of the other indications could be the eccentric location of an endodontic file on a radiograph during working length determination, inconsistent apex locator readings, a sinus tract that traces laterally away from the main canal, or the feeling of a 'catch' on the canal wall during instrumentation of a wide and unobstructed main canal.

Careful interpretation of the radiographic features is essential in order that root canals are not overlooked. This depends on the availability of good and accurate periapical radiographs and, ideally, periapical radiographs taken from at least two different horizontal angles. In the

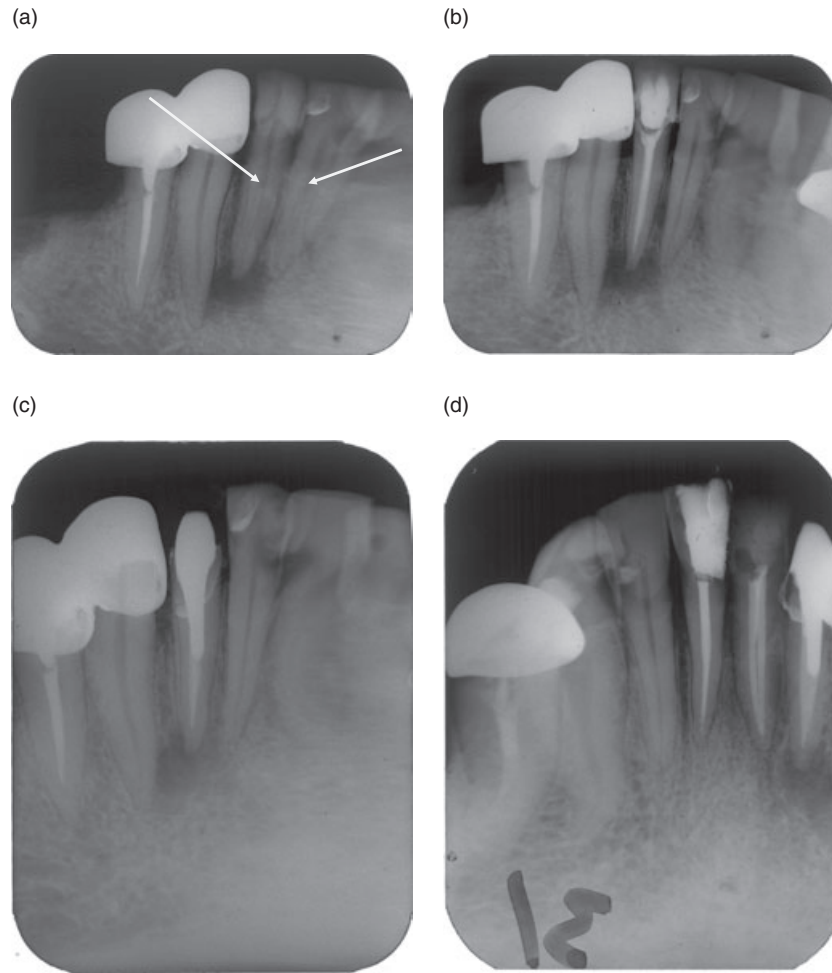


Figure 2 Case report 2. (a) Preoperative periapical radiograph of the mandibular right lateral incisor. Arrows indicate the bifurcation of the root canals in the right central and lateral incisors. (b) Postoperative periapical radiograph following endodontic treatment of the mandibular right lateral incisor. (c) The 12-month review radiograph of the mandibular right lateral incisor showing considerable reduction in the size of the periapical radiolucency. (d) Postoperative radiograph after endodontic treatment of the mandibular right and left central incisors. This radiograph was taken 14 months after the radiograph in Figure 2c. Further reduction in the size of the radiolucency associated with the mandibular lateral incisor is evident.

presented cases, there were no signs of the second root canals on the panoramic radiograph and the periapical radiographs taken with standard ('straight on') angles were not sufficient to detect the second canals in each tooth. Some teeth had signs suggestive of additional canals, such as a significant change (or complete disappearance) of the lumen in the coronal third of the root on the periapical radiograph, but a clear pattern was noted only after changing the horizontal angles.

Careful examination of the tooth before and during access cavity preparation is essential along with thorough probing of the pulp chamber. A common reason for not locating a second canal in mandibular incisors is an inadequate access opening into the tooth which leaves a lin-

gual shelf of dentine over the second (usually the lingual) canal (4). These authors recommended that when entering mandibular incisors in order to perform endodontic treatment, clinicians should always initially assume that two root canals exist. Therefore, clinicians should always prepare an access cavity with the appropriate size and location, and then thoroughly search for the two canals. Only after such a search fails to reveal a second canal should clinicians be satisfied that the tooth has only one root canal.

There were no clinical and radiographic signs of unfavourable treatment outcomes in the two presented cases. In all retained incisors in Case 1 and the two central incisors in Case 2, the width of the periodontal ligament

spaces remained consistent after treatment while the radiolucency associated with the right lateral incisor in Case 2 reduced in size throughout the follow-up period, which indicated that healing was occurring. Thus, these cases demonstrate that conventional root canal therapy can be an acceptable treatment modality for teeth with anatomical irregularities provided all canals are located, cleaned, disinfected and filled adequately.

Conclusion

These case reports highlight the importance of having a thorough knowledge of all possible root canal irregularities. In some cases, it is very difficult to identify additional root canals by radiographic examination and therefore visualisation and deep probing during initial endodontic treatment is essential for the location of all canals. With advances in modern endodontic techniques, most teeth with complex root canal anatomies can be successfully treated without surgical intervention.

References

1. Carrotte P. Endodontics: Part 4. Morphology of the root canal system. *Br Dent J* 2004; 197: 289–367.
2. Karagöz-Küçükay I. Root canal ramifications in mandibular incisors and efficacy of low-temperature injection thermoplasticized gutta-percha filling. *J Endod* 1994; 20: 236–40.
3. Miashita M, Kasahara E, Yasuda E, Yamamoto A, Sekizawa T. Root canal system of the mandibular incisor. *J Endod* 1997; 23: 479–84.
4. Benjamin KA, Dowson J. Incidence of two root canals in human mandibular incisor teeth. *Oral Surg* 1974; 38: 122–6.
5. Funato A, Funato H, Matsumoto K. Mandibular central incisor with two root canals. *Endod Dent Traumatol* 1998; 14: 285–6.
6. Reid JS, Saunders WP, MacDonald DG. Maxillary permanent incisors with two root canals: a report of two cases. *Int Endod J* 1993; 26: 246–50.
7. Low D, Chan AWK. Unusual maxillary lateral incisors: case reports. *Aust Endod J* 2004; 30: 1–5.
8. Iqbal MK, Gartenberg J, Kratchman SI, Karabucak B, Bui B. The clinical significance and management of apical accessory canals in maxillary central incisors. *J Am Dent Assoc* 2005; 136: 331–5.
9. Kusiak A, Sadlak-Nowicka J, Limon J, Kochanska B. Root morphology of mandibular premolars in 40 patients with Turner's syndrome. *Int Endod J* 2005; 38: 822–6.
10. Katral N, Yanikoğlu FÇ. Root canal morphology of mandibular incisors. *J Endod* 1992; 18: 562–4.