

# Exploring Two-Canal Endodontic Treatment in Mandibular Lateral Incisors: A Review of the Literature and Case Series

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## ABSTRACT

Case reports of canal variation in mandibular lateral incisors are relatively rare. This report utilizes a dental microscope to detail the endodontic treatment process for mandibular lateral incisors with two canals, along with clinical considerations for crown restoration following root canal treatment. It emphasizes the crucial role of the dental microscope in accurately identifying root canal variations to ensure successful pulp treatment. Additionally, we reviewed the literatures on canal variation in mandibular lateral incisors and summarized the research on this topic. The aim of this report is to discuss the challenges encountered and the strategies for managing such cases.

## CASE REPORT

### CASE REPORT

#### Case 1

The 63-year-old female sought treatment for persistent pain in her mandibular anterior teeth after being treated in an outside hospital, the pain did not relieve. Intraoral examination showed cavities in the mandibular lateral incisors, and radiographs confirmed a blurred root canal (Figure 1a). Under rubber dam isolation, the root canal orifice was identified in buccal and lingual directions (Figure 1b). Two root canals (buccal and lingual) were confirmed using K-files, and the working length was measured with an electronic apex locator. Initial canal preparation utilized a hand-held 10# stainless steel file, followed by rotary instrument (Figure 1c). The canals were irrigated, dried, and filled with calcium hydroxide medication. The patient returned a week later. After removing the calcium hydroxide, the canals were filled with thermoplasticized gutta-percha and sealed with a bioceramic sealer (Figure 1d). A periapical radiograph

FI confirmed the complete sealing (Figure 1e) and a metal post crown was selected for restoration (Figure 1f-1h).

#### CASE 2

A 46-year-old male sought treatment to preserve his remaining tooth after biting hard objects. Examination revealed lingual caries on the mandibular lateral incisors and root canal orifice leakage. A periapical radiograph confirmed abnormal root morphology (Figure 2a). After removing decayed tissue, K-files identified two canals (Figure 2b), which were cleaned and prepared using an electronic apex locator and a hand-held 15# file, followed by rotary instrument (Figure 2c). Canals

were irrigated with sodium hypochlorite, EDTA, and hydrogen peroxide, then dried and filled with calcium hydroxide. The patient returned asymptomatic after one week. Following removal of calcium hydroxide, canals were filled with thermoplasticized gutta-percha and sealed with a bioceramic sealer (Figure 2d,2e). The pulp cavity was restored with composite resin (Figure 2f). Follow-up radiographs confirmed the complete seal of the root canals (Figure 2g,2h).

### DISCUSSION

Understanding the internal anatomical structure of root canal and their variations is essential for effective pulp treatment. Recently, we treated three cases of mandibular lateral incisors with two canals and noted only two case reports on clinical experience in root canal therapy of mandibular lateral incisors [1,2]. Therefore, we summarized our clinical treatment experience with mandibular lateral incisors exhibiting root canal variation, along with a review of the relevant research on this topic.

#### Etiology & demographics

Various methods, both in vitro and in vivo, are available to assess root canal morphology, including cross-sectioning, the clearance technique, microscopic examination, conventional and digital radiography, cone-beam computed tomography (CBCT), and micro-computed tomography (micro-CT) [3]. In mandibular incisors, the prevalence of two root canal therapy varies greatly with geographical location, race, age and gender. Total prevalence of mandibular lateral incisors was 26.0% (table 1) [4]. It is suggested that the presence of a second buccal

canal in the maxillary first molar is likely when at least one mandibular incisor shows additional canals [5]. Reports indicate that approximately 33.3% of mandibular lateral incisors have missed canals during endodontic treatment [6]. Given that the detection of a second canal varies by examination methods, clinicians should exercise extra caution to avoid overlooking these canals when treating mandibular lateral incisors.

### Clinical & imaging findings

Recent advances in technology and methodology have significantly enhanced the outcomes and predictability of endodontic treatment. Common approaches to determine the number of root canals include clinical observation, cleaning techniques, clinical microscope examination, and radiography [7]. Some studies indicate that cleaning techniques is the most effective for assessing the number and shape of root canals, followed by clinical microscope and clinical observation. While CBCT or micro-CT provide the highest accurate for evaluating root canal variation prior to treatment, it is essential to adhere to ALARA principles when employing these techniques [8]. In the three cases presented in this report, We didn't utilize CBCT to assess root canal morphology; instead, we relied on cleaning techniques and an dental microscope to evaluate canal structure and number.

### Treatment & prognosis

Missing root canal are a significant factor contributing to the failure of root canal treatment, with periapical lesions occurring at a rate 4.38 times higher in such cases [9]. Thorough debridement and disinfection of the root canal system are crucial for a successful outcome. Key steps in effective root canal treatment include meticulous cleaning of the root canal, root canal irrigation and disinfection, and proper sealing of the root canal. Regular follow-up evaluations post-treatment serve as an effective means to assess the prognosis of endodontic therapy.

### TEACHING POINT

The occurrence of two canals in mandibular lateral incisors is relatively common. Endodontists should carefully explore for additional root canals to avoid missing canal.

### AUTHORS' CONTRIBUTIONS

Chongchong Guo and Li Wang contribute equally to this study. GC and WL were responsible for collecting and sorting out cases.

Na Guo and Xiufen Tian contribute equally to this study, Drafting of the manuscript was performed by TF and GN. All authors contributed to the article and approved the final manuscript.

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No application

### DISCLOSURES

The authors declared that they have no conflicts of interest to this work.

### CONSENT

Yes

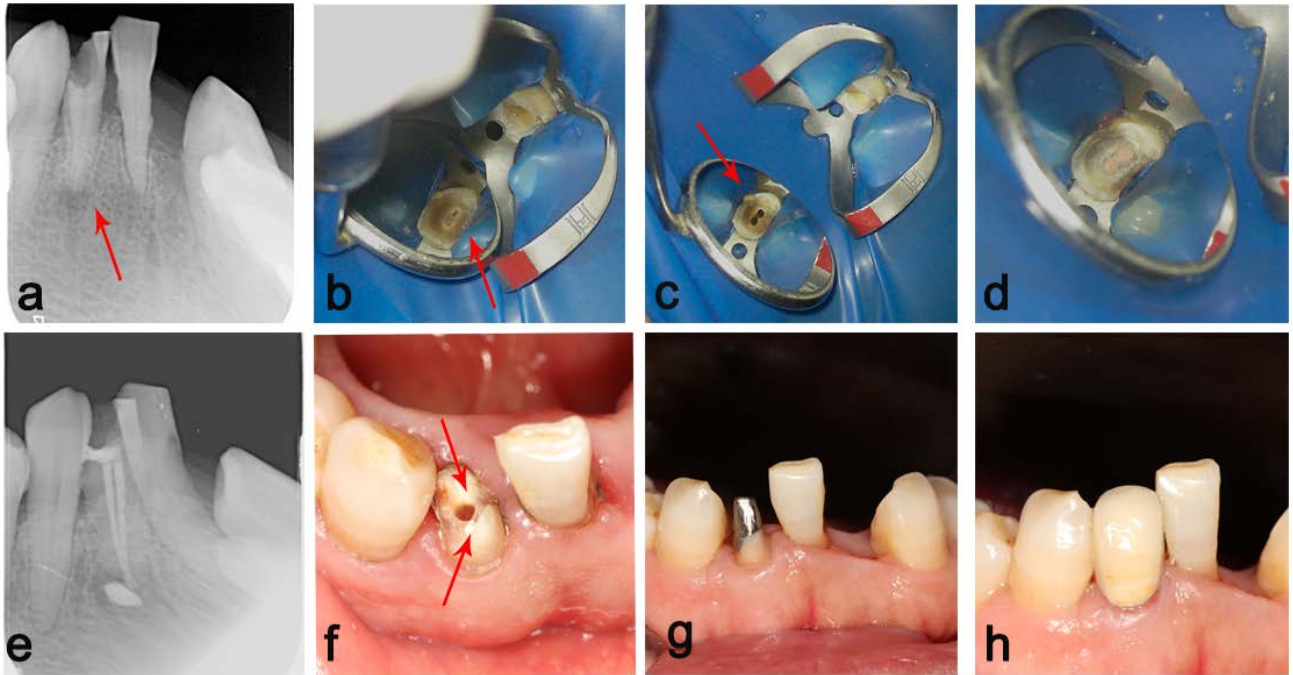
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No application

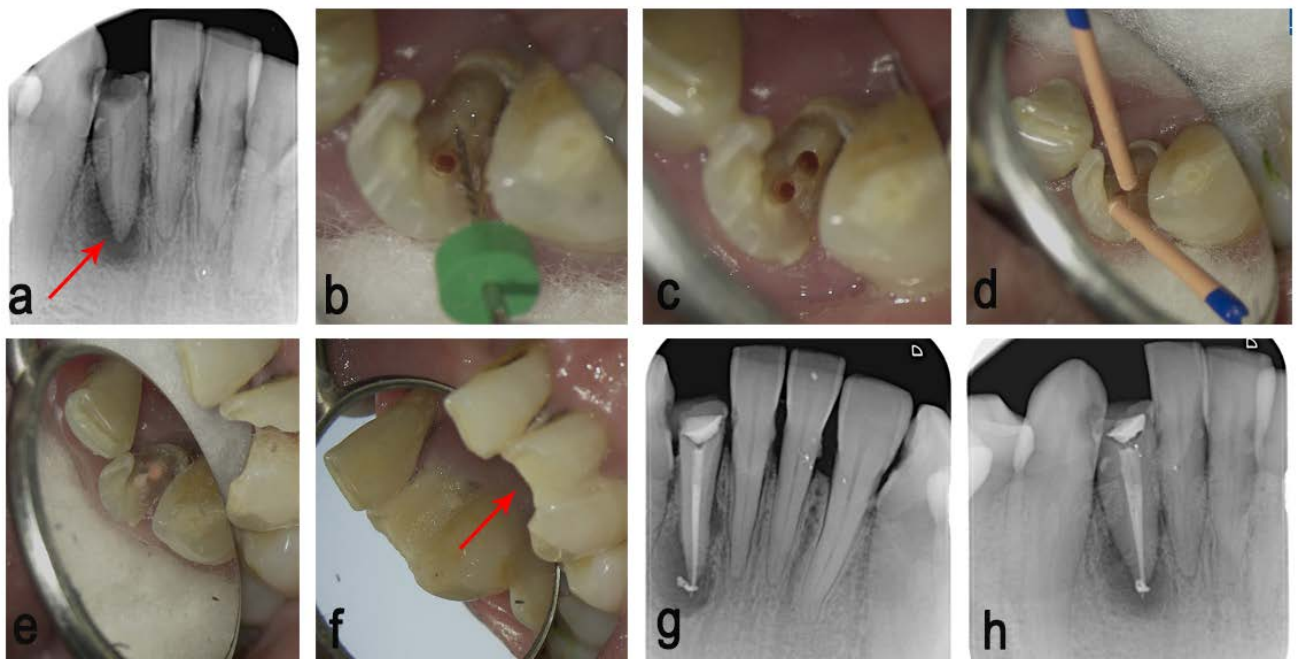
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FIGURES



**Figure 1:** (a) Initial pretreatment radiograph indicating a blurred root canal, with red arrows. (b) Intraoral photograph showing the pulp chamber of the mandibular lateral incisor. (c) Intraoral photograph showing two canal orifices. (d) Root canal filling using the thermo-coagulation technique. (e) Post-obturation radiography. (f-h) Intraoral photographs illustrating the post & crown restoration.



**Figure 2:** (a). Initial pretreatment radiograph illustrating abnormal root morphology of the mandibular lateral incisor. (b and c). Intraoral photographs showing two independent root canals in a buccal-lingual orientation. (d and e) Root canal filling using the thermo-coagulation technique. (f) Complete root canal treatment with resin restoration. (g) Post-obturation radiography. (h) Follow-up radiography.

## TABLES

**Table 1:** Summary of prevalence of two canals in mandibular lateral incisors

No.	Study	Population	Total	variation rate,n (%)	Method of study	PubMed ID
1	Maluf TC	southern Brazil	176	13.64	CBCT	38920123
2	Howait M	Western Saudi Arabian sub	1600	23.2	CBCT	38899247
3	Sheth K	Indian	400	34.8	CBCT	38172235
4	Sevgi U	NA	160	17.50	micro-CT	38147175
5	Liu J	Chinese	6770	39.2	CBCT	37548258
6	Martins JNR	Nigeria	NA	0.06-4.0	CBCT	37225039
		Syria		39.7-51.0		
		Nigeria		0.06-4.0		
		India		49.4-60.6		
7	Tang Y	Chinese	53	30.2	micro-CT	36890470
8	Aoki K	Japanese	NA	12.3	CBCT	36760198
9	Alaboodi RA	Saudi subpopulation	464	31.8	CBCT	35991262
10	Mashyakhy M	Saudi Arabian	1138	42.6	CBCT	35958809
11	Alshayban M	Saudi subpopulation	590	31	CBCT	35814846
12	Almohaimede A	Saudi	683	27.37	CBCT	35646406
13	Buchanan GD	South African	387	33.9	CBCT	35644562
14	Lee JB	NA	300	36.00	CBCT	35473630
15	Yang Y	Cantonese	1016	24.61	CBCT	35429982
16	Mahmood Talabani R	Iraqi subpopulation	599	29.22	CBCT	34484586
17	Zhu JX	Chinese	866	17.21	CBCT	32974620
18	Lima CO	NA	NA	10.1	micro-CT	32621597
19	Baxter S,	NA	302	20.5	CBCT	32224571
20	Mashyakhy M	Saudi Arabian	822	30.8	CBCT	31719285
21	Valenti-Obino F	NA	491	43	CBCT	31346372
22	Mirhosseini F	Iranian	681	29.7	CBCT	30937333
23	Pan JYY	Malaysian	NA	12.3	CBCT	30642318
24	Saati S	NA	NA	21.8	CBCT	29972448
25	Wang M	NA	100	29	micro-CT	29564557
26	Wu YC	NA	NA	25	CBCT	29079050
27	Shemesh A	Israeli	1508	37.9	CBCT	29033082
28	Zhengyan Y	Chongqing	3257	0.3	CBCT	26730198
29	Leoni GB	NA	NA	28	micro-CT	24767569
30	Zhao Y	NA	1566	17.4	CBCT	24535357
31	Lin Z	NA	1412	25.5	CBCT	24515289
32	Liu J	Chinese	NA	17.5	CBCT	24255962

## KEYWORDS

*Mandibular lateral incisor; root canal treatment; root canal anatomical variation; dental microscope*

## ABBREVIATIONS

CBCT = CONE BEAM COMPUTED TOMOGRAPHY

NA = NO APPLICATION

MICRO-CT = MICRO COMPUTED TOMOGRAPHY

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