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Endodontic management of mandibular central incisor with two canals: A case report

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Abstract
Presence of two canals in mandibular central incisors is an important anatomical variation that may be missed during endodontic treatment, resulting in persistent symptoms and treatment failure. A 41-year-old male patient reported with spontaneous pain and sensitivity in the lower anterior region of the jaw. Clinical examination and pulp sensibility testing revealed symptomatic irreversible pulpitis in relation to the mandibular central incisor. Conventional radiographic examination suggested the possibility of a second canal arranged in a labial-lingual configuration. Nonsurgical root canal treatment was carried out using rotary instrumentation, copious irrigation, sonic activation of irrigants, and obturation with gutta-percha and AH Plus sealer. At follow-up, the patient remained asymptomatic with satisfactory clinical and radiographic outcomes. This case highlights the importance of careful radiographic assessment, modified access cavity preparation, and magnification in the successful management of anatomical variations in mandibular anterior teeth.

Keywords: Two canals, mandibular central incisor, anatomical variation, root canal morphology, nonsurgical root canal treatment

Introduction
A thorough understanding of root canal morphology is one of the most critical factors for successful endodontic treatment.[1] Failure to detect and treat additional canals is a major cause of persistent infection and endodontic failure.[1, 6] Mandibular anterior teeth, particularly central incisors, are generally described as having a single root and single canal. However, anatomical studies and clinical reports have demonstrated the presence of two canals in these teeth with varying prevalence among different populations.[2-5]
The second canal is usually located lingually and often remains unnoticed because of the narrow mesiodistal dimension and ribbon-shaped root morphology of mandibular incisors. These canals may join apically or continue as separate canals with separate foramina. Conventional periapical radiographs may fail to reveal this anatomical variation due to superimposition of structures and the two-dimensional nature of imaging.[6]
Careful clinical examination, use of multiple radiographic angulations, magnification, and illumination can significantly improve detection of additional canals.[6-8] This case report describes the diagnosis and successful management of a mandibular central incisor presenting with two canals in a labial-lingual configuration.

Patient Information
Demographic Information
A 41-year-old male farmer reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain and sensitivity in the lower front tooth region for the past four days.

Chief Complaint
The patient complained of spontaneous pain and sensitivity in the lower front tooth, especially while consuming cold beverages.

History of Present Illness
According to the patient, the pain initially started as mild discomfort but gradually increased in intensity over four days. The pain was sharp, spontaneous in nature, aggravated by cold stimuli, and persisted for several minutes after removal of the stimulus. There was no history of trauma, swelling, or pus discharge.

Medical History
- No history of systemic illness such as diabetes mellitus or hypertension
- No known drug allergies
- No history of previous surgeries
- Not under any long-term medication

Dental History
The patient had no relevant previous dental history.

Family and Psychosocial History
No relevant family history or psychosocial factors contributing to the condition were reported.

Patient Perspective
The patient expressed concern regarding the increasing severity of pain and difficulty in consuming cold beverages. Following treatment, the patient reported significant relief from symptoms and satisfaction with the outcome.

Clinical Findings
Intraoral examination revealed no visible swelling, sinus tract, or discoloration associated with the involved tooth.

Vitality Testing
The following diagnostic tests were performed:
- **Cold test (Endo-Ice):** Lingering pain for more than 30 seconds
- **Electric pulp test (EPT):** Positive exaggerated response

- **Heat test:** Mild painful response
- **Percussion test:** Tender
- **Palpation test:** Non-tender

Based on clinical findings, the tooth was diagnosed with symptomatic irreversible pulpitis.

Diagnostic Assessment
Preoperative periapical radiographic examination revealed:
- Absence of periapical radiolucency
- Slight widening of periodontal ligament space
- Suggestive radiolucent line indicating possible division of the canal space
- No evidence of root resorption or calcification
- No associated traumatic injury

The radiographic appearance suggested the possibility of an additional canal in the mandibular central incisor with a labial-lingual configuration.

Diagnostic Challenges
Detection of the additional canal was challenging because of the narrow mesiodistal dimension of the mandibular incisor and superimposition of structures in conventional radiographs.

Diagnosis
Tooth Involved
Mandibular central incisor
Pulpal Diagnosis
Symptomatic irreversible pulpitis
Periapical Diagnosis
Normal apical tissues
Anatomical Variation
Presence of two canals in a labial-lingual configuration

Therapeutic Intervention
The treatment plan included:
1. Non-surgical root canal treatment
2. Identification and management of both canals
3. Cleaning, shaping, and obturation of the complete canal system
4. Permanent coronal restoration with composite resin

Treatment Procedure
Anesthesia and Isolation
Local anesthesia was administered using 2% lidocaine with epinephrine. Rubber dam isolation was achieved to maintain aseptic conditions.

Access Preparation
Conventional access cavity preparation was performed using an Endo-Z bur. The access cavity was modified slightly toward the lingual aspect to facilitate identification of an additional canal.

Canal Identification
Careful exploration of the pulp chamber floor was carried out using a DG-16 endodontic explorer under magnification. Two canals were identified:
- Labial canal
- Lingual canal

Working length determination was performed using an electronic apex locator and confirmed radiographically.

Cleaning and Shaping
Initial glide path preparation was performed using #10 and #15 K-files. Rotary instrumentation was completed using ProTaper Gold rotary instruments up to F2.
Irrigation protocol included:
- 2.5% sodium hypochlorite
- 17% EDTA

Irrigant activation was performed using sonic agitation with EndoActivator.

Obturation
Both canals were dried using paper points and obturated with gutta-percha and AH Plus sealer using the cold lateral compaction technique.
Post-obturation radiograph demonstrated satisfactory obturation of both canals.

Temporary Restoration
Glass ionomer cement was placed as a temporary restoration. Permanent composite restoration was planned during the follow-up visit.

Follow-Up and Outcomes
The patient was reviewed after one week and reported complete resolution of pain and sensitivity. Clinical examination revealed absence of tenderness on percussion and palpation. The tooth remained functional and asymptomatic.
Postoperative radiographic assessment demonstrated satisfactory obturation of both canals with no evidence of procedural complications.

Discussion
Knowledge of root canal anatomy and its variations plays a decisive role in successful endodontic treatment.[1] Mandibular anterior teeth are often considered straightforward for endodontic therapy because of their relatively simple anatomy.[1] However, numerous anatomical studies have reported the presence of two canals in mandibular incisors with prevalence ranging from 20% to 45%.[2-5]
The additional canal is usually located lingually and may remain undetected because of the narrow mesiodistal dimension of the tooth. Failure to identify and treat this canal may lead to persistent symptoms, post-treatment disease, and eventual failure of root canal therapy.[1,6]
Several authors have emphasized the importance of modifying the access cavity toward the lingual aspect to improve visibility and accessibility of the second canal.[6,7] Multiple preoperative radiographs taken at different horizontal angulations can provide important clues regarding canal bifurcation. The use of magnification and illumination further enhances canal detection.[6]
Careful radiographic interpretation plays an important role in identifying anatomical variations in root canal morphology.[6,8] Multiple angulated radiographs and careful exploration of the pulp chamber floor improve the detection of additional canals in mandibular anterior teeth.[6,7]

In the present case, careful radiographic evaluation, modified access preparation, and use of magnification enabled successful identification and treatment of both canals. Proper cleaning, shaping, irrigation, and obturation contributed to favourable treatment outcome.[1,7]

Clinical Significance

- Mandibular central incisors may present with two canals more frequently than commonly expected.
- Additional canals are often located in a labial-lingual orientation.
- Missed canals are a common cause of endodontic failure.
- Magnification, illumination, and angled radiographs improve canal detection.
- Careful radiographic assessment is important in identifying complex anatomical variations.

Figure Legends

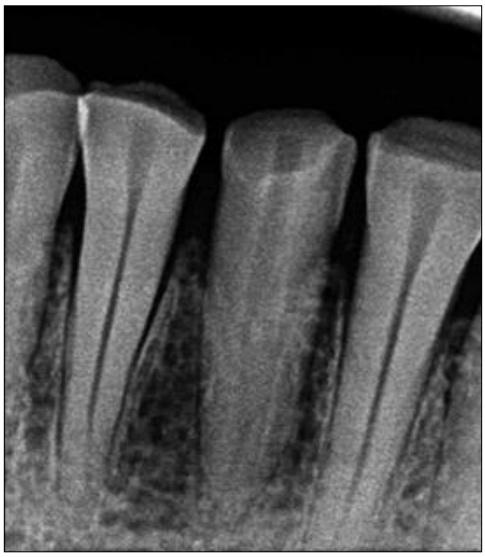

Fig 1: Preoperative intraoral periapical radiograph showing suggestive evidence of an additional canal

Fig 2: Access cavity preparation demonstrating modification toward the lingual aspect

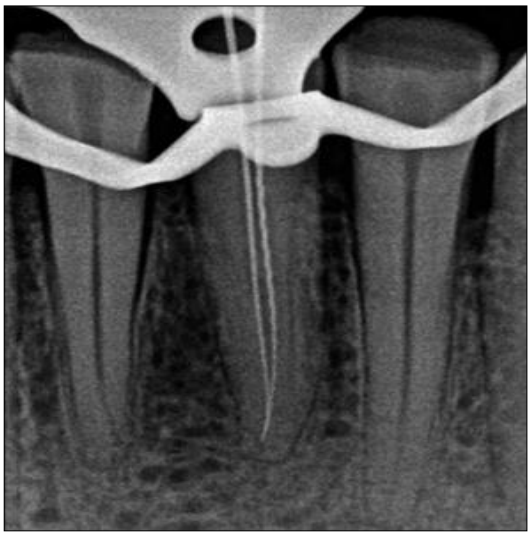

Fig 3: Working length radiograph showing labial and lingual canals

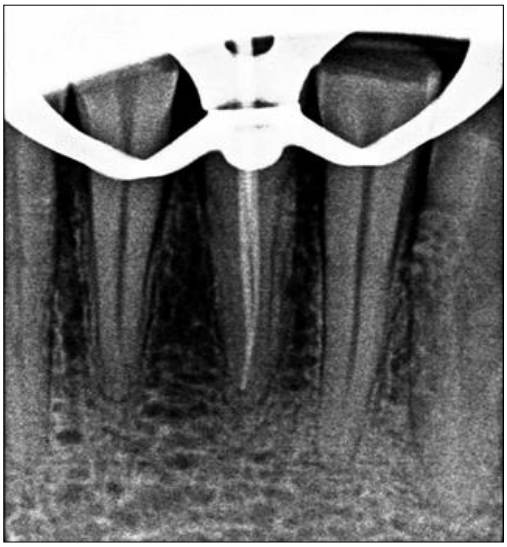

Fig 4: Post-obturation radiograph demonstrating satisfactory obturation of both canals

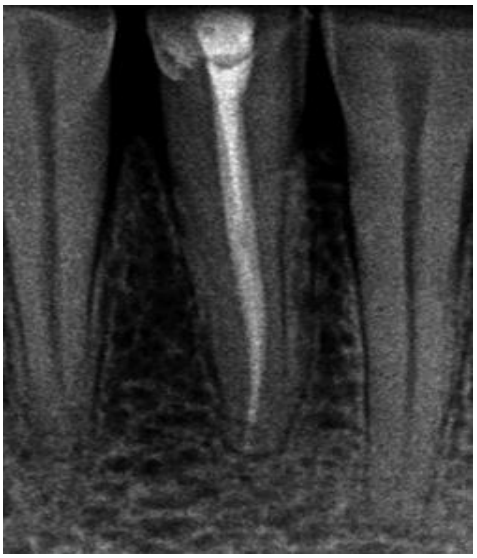

Fig 5: Post- endodontic restoration radiograph demonstrating satisfactory coronal seal

Conclusion

This case report emphasizes the importance of recognizing anatomical variations in mandibular anterior teeth. Although mandibular central incisors are generally considered to have a single canal, the possibility of an additional canal should always be considered during endodontic treatment.

Careful clinical examination, proper radiographic interpretation, modification of access cavity design, and use of magnification are essential for successful identification and treatment of additional canals. Thorough biomechanical preparation and complete obturation of the entire canal system are critical for achieving long-term endodontic success.

Timeline

Timeline	Clinical Event
Day 1	Patient presented with spontaneous pain and sensitivity
Day 1	Clinical examination and vitality testing performed
Day 1	Radiographic examination suggested additional canal
Day 1	Diagnosis of symptomatic irreversible pulpitis established
Day 1	Root canal treatment initiated and completed
1-week follow-up	Patient asymptomatic with satisfactory healing

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