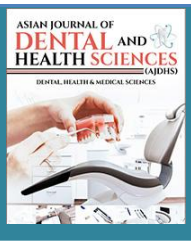

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Mandibular Incisors with Two Canals: A Case Series Highlighting Diagnostic and Clinical Challenges

Khandelwal Akansha *[1], Heda Anant [2], Nagpal Ravi [3], Gupta Vyankatesh [1], Lodha Riddhi [4], Parkale Pranali [4]

[1] IIIrd PG Student, R. R. Kambe Dental College and Hospital, Akola.

[2] Professor, R. R. Kambe Dental College and Hospital, Akola.

[3] HOD and Professor, R. R. Kambe Dental College and Hospital, Akola.

[4] IInd PG Student, R. R. Kambe Dental College and Hospital, Akola.

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*Address for Correspondence:

Khandelwal Akansha, IIIrd PG Student, R. R. Kambe Dental College and Hospital, Akola.

Abstract

Mandibular incisors are traditionally described as having a single root and a single canal. Traditionally, it is considered the simplest tooth to treat endodontically. However, numerous studies have reported anatomical variations in the anterior teeth of the mandible. Mandibular incisors frequently exhibit anatomical variations, including the presence of a second root canal, which is often located lingually. This lingually placed canal is often overlooked by clinicians due to the narrow mesiodistal dimension of the tooth, superimposition on conventional radiographs, and limited understanding of the complex internal anatomy. The clinicians often fail to locate the lingual canal due to a lack of experience and understanding of root canal morphology, leading to continuing periapical pathology and eventual endodontic failure. Consequently, a thorough diagnostic approach is essential. The use of multiple angulated periapical radiographs, and where indicated, advanced imaging techniques, can greatly enhance the detection of canal bifurcations. In addition, carefully modified access cavity designs that extend slightly towards the cingulum improve the likelihood of locating the lingual canal orifice. The report emphasizes careful radiographic evaluation, modified access cavity design, and the use of magnification for identification and management of the lingual canal. This case series aims to describe the diagnosis and location of nonsurgical endodontic management of mandibular incisors with two canals, emphasizing the clinical and radiographic identification for successful treatment.

Keywords: Endodontic treatment, Two canals, Bifurcation

Introduction

For a successful endodontic therapy, thorough knowledge of root canal morphology along with the variations is necessary. Clinically, 41.4% of mandibular incisors demonstrate two distinct root canals, whereas only 1.3% present with two separate canals terminating in two independent apical foramina.[1] The most common configuration present is Vertucci Type II or Type III. The complexity and variability of root canal systems possess diagnostic and therapeutic challenges in endodontic treatment, particularly in the mandibular anterior region where the canals are narrow and potentially curved.[2]

Failure by the operator to recognize the root canal anatomy and undetected second canals extend beyond clinical failure to affect treatment prognosis and the long-term tooth survival rate.[3] Consequently, careful evaluation using multiple angled radiographs, CBCT, modified access cavity designs and incorporation of modern endodontic instruments facilitate improved clinical outcomes.[4]

The purpose of the following case series is to discuss the treatment of an unusual occurrence of second canal present in mandibular lower anterior.

Case report

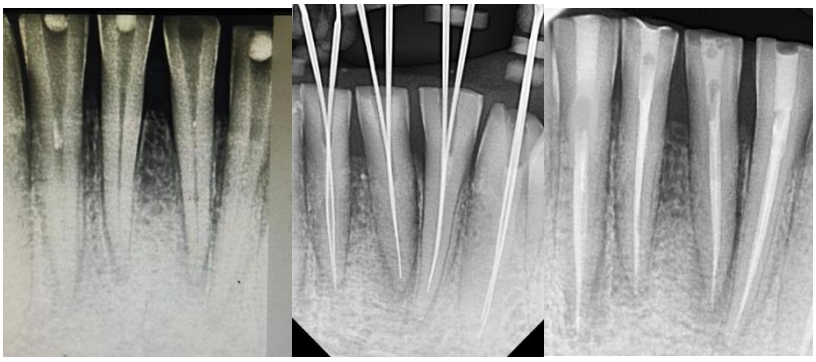
Case 1:

A 32-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Dr R. R. Kambe Dental College and Hospital, Akola, with pain in the lower anterior region for a month. Patient visited the dentist 20 days ago, but unfortunately, there has been no improvement in symptoms following the treatment. The medical history was non-contributory. The clinical examination revealed pain on percussion with 32 to 42. Vitality tests on teeth showed no response on cold, hot and electric pulp test (EPT). Radiographic examination revealed extra radiolucent outline in the radicular region.

Continuation of endodontic treatment was carried out for teeth 32, 31, 41, 42 under local anaesthesia. The existing restoration was removed and access cavity refined. Initial exploration located a single canal orifice;

however, a file placed in the canal appeared off-center on a radiograph, suggesting a missed second canal. Troughing along the lingual wall resulted in identification of a second lingual canal.

The canals were negotiated with small K-files and prepared using a crown-down rotary technique. Irrigation was performed using sodium hypochlorite, EDTA, and saline. The canals exhibited separate paths coronally and merged in the middle third, again consistent with Vertucci Type II configuration. Obturation was completed with gutta-percha and resin sealer. A full-coverage all-ceramic crown was placed after one month. At a 1-year review, the patient remained symptom-free and radiographs showed complete resolution of the periapical lesion.

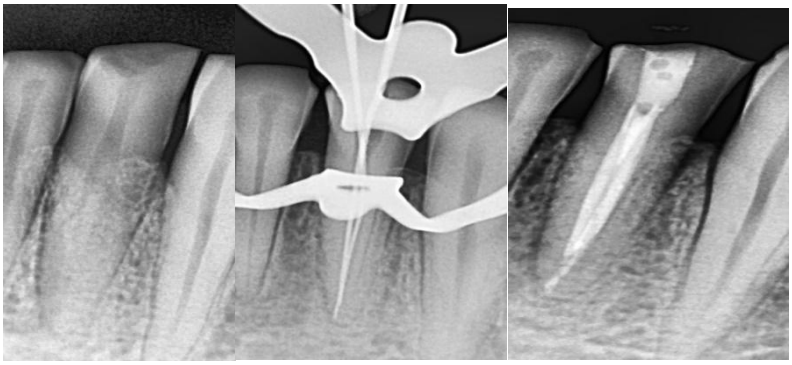


Case 2:

A 42-year-old female patient visited the Department of Conservative Dentistry and Endodontics at Dr R. R. Kambe Dental College and Hospital, Akola, with pain in the lower anterior region for 2 days. The pain was continuous and throbbing and elevated on taking cold beverages. Clinical examination revealed attrition at 32, which was tender to percussion and responded immediately to the electric pulp test. Radiographic examination revealed a narrow root with a vague double canal outline.

The tooth was diagnosed as pulpal necrosis with symptomatic apical periodontitis in tooth 32.

After obtaining informed consent, local anaesthesia was administered, and rubber dam isolation was applied. An access cavity was prepared with a modification to extend the buccolingual approach to navigate the altered occlusal anatomy resulting from attrition and to locate both canals' orifices. Using a DG16 explorer, two distinct canal orifices were identified. Working length was determined using an electronic apex locator and verified radiographically. Biomechanical preparation was performed with rotary NiTi files using a crown-down technique, followed by copious irrigation with 2.5% sodium hypochlorite and 17% EDTA to disinfect the canals thoroughly. Both canals were cleaned and shaped to an apical size of 25/.04 taper. The canals were dried and obturated using single cone obturation technique and bioceramic sealer to ensure a hermetic seal. The access cavity was restored with composite resin for adequate seal and esthetics. At the 6-month follow-up, the patient was asymptomatic.



Case 3:

A 19-year old male patient reported to the Department of Conservative Dentistry and Endodontics, Dr. R. R. Kambe Dental College and Hospital, Akola with pain in lower anterior region since a month. The patient had history of trauma to lower left lateral incisor 8 years ago. The crown was fractured from cervical area. Pain on percussion was negative and no response on cold, hot and electric pulp test (EPT). Radiographic examination revealed presence of two canals with 32. No root fracture was evident. Based on clinical and

radiographic findings, a diagnosis of pulpal necrosis with chronic apical periodontitis was made for tooth 32.

After obtaining informed consent, local anesthesia was administered, and the tooth was isolated using a rubber dam. The access cavity was carefully prepared with an extended buccolingual towards the cingulum to aid in locating the lingual canal orifice. Under magnification, two distinct canal orifices were identified—one buccal and one lingual—with the lingual orifice located beneath what remained of the cingulum.

Working length was determined using an electronic apex locator and confirmed radiographically. Canal instrumentation was performed using nickel-titanium rotary files coupled with copious irrigation with 2.5% sodium hypochlorite and 17% EDTA to disinfect both canals effectively.

The canals were dried and obturated using warm vertical compaction with gutta-percha and bioceramic sealer to ensure a hermetic seal. Followed by obturation fibre post was placed and prosthesis was given.

At the 6-month follow-up, the patient was asymptomatic and functional. Radiographs demonstrated significant reduction of the periapical radiolucency and healing of periapical tissues.

Discussion:

The main objective of root canal treatment is thorough debridement of the pulp canal space and obturation with an inert material. Absolutely, the sudden change in canal radiodensity or an abrupt disappearance of canal space provide clues of an additional canal present.[5] The most common pattern observed in these cases was Vertucci Type II, where two canals join into one before the apex, though distinct canals to the apex are also possible.[6] Failure to detect the second canal is a recognized cause of endodontic failure in the mandibular anterior region.

Because of the small internal anatomy of mandibular incisors, it is considered as one of the most difficult to treat.[7] The unusual anatomy of two canals that are buccolingually oriented is the most common cause of endodontic failure, the most commonly missed being the lingual canal.[1] To avoid missing the canal, certain points need to be considered.

- Thorough knowledge of the root canal morphology and clinician's experience.
- Careful interpretation of preoperative radiographs, using multiple angulation radiographs to detect canal bifurcation.[8]
- Use of magnification and adequate illumination to identify additional canal orifices, especially by extending access towards the cingulum.[1]
- Troughing with small ultrasonic tips or hand instruments along the lingual wall, when radiographic suspension is high.
- Reliance on electronic apex locators and working length radiographs to confirm canal configuration.
- In retreatment cases, a persistent lesion in mandibular incisor should always raise suspicion of a missed lingual canal.[9]

Awareness of this anatomical variation and systematic search for a second canal can significantly improve prognosis of mandibular incisor endodontic therapy.

Conclusion

Mandibular incisors can frequently present with two canals, and failure to recognize this variation can lead to missed anatomy, persistent infection, and eventual treatment failure. Careful assessment with multiple angulated radiographs, detailed clinical exploration, and, when available, advanced imaging greatly improves detection of these additional canals. Modified access cavity designs that extend slightly lingually, combined with the routine use of magnification and adequate illumination, help locate and negotiate the often-hidden lingual canal. When both canals are properly identified, cleaned, shaped, and obturated, the prognosis of mandibular incisors improves significantly, as illustrated in the reported case series.

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