

Endodontic Management of Biradicular Maxillary Central Incisor: A Case Report

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The complex root canal system morphology in rare cases can complicate the root canal treatment and cautious management of the case is mandatory. The aim of this case report is to illustrate the successful endodontic management of biradicular maxillary central incisor with the aid of three-dimensional cone-beam computed tomography. A 36-year-old female was referred to the Department of Endodontics with the chief complaint of spontaneous pain in the anterior region of maxilla. Complete clinical examination revealed no tenderness to percussion and palpation and no periodontal pocket was measured. Maxillary right central incisor was sensitive to cold and other adjacent teeth responded within normal limits. Preoperative radiographs showed normal periodontal ligament spaces. By using bisecting angle technique at different angles, the presence of a second root was confirmed based on the Same Lingual Opposite Buccal (SLOB) rule. A diagnosis of irreversible pulpitis by clinical, radiographic, and CBCT examination was made. The entire procedure that has been undergone is described including pulpal and periapical examination together with adjunctive conventional radiography and CBCT, access cavity preparation, root canal shaping, and final obturation. A 1-year follow-up showed asymptomatic tooth and proved CBCT to be useful to manage endodontic anatomic variations. The dental pulp within tooth crown and root canal, also known as root canal system, is deemed to have various morphologies and has been categorized into different classes by many studies. Detecting the variations in the anatomical configuration of the root canal system by various techniques will help to improve the success rate of endodontic treatment. Previous case reports concerning maxillary incisors and their unusual anatomy were also reviewed to identify research gaps and limitations.

Keywords: Anatomic variation, Cone beam computed tomography, Root canal therapy, Tooth abnormalities.

1. Introduction

Research on tooth anatomy and anatomical variations is necessary for dental treatments. Various studies have been conducted on the anatomy of the root canal to perform root canal treatments. In most studies, maxillary incisors do not usually have complex anatomy and comprise a single canal; however, anatomical variations have been observed in these teeth (1).

These anatomical variations mostly appear as two roots and two canals, one root and two canals, dens invaginatus, fusion, and gemination (2). The occurrence of multiple roots and multiple canals has been also reported in these teeth, mainly in the lateral maxillary teeth (3, 4). According to less recent studies, central maxillary teeth have a single canal in 100% of cases (1, 5, 6). On the other hand, in a review study of maxillary central teeth, only three teeth with two canals and one root were reported as

well as six teeth with two canals and two roots (7). So far, the highest prevalence of teeth with extra roots has been detected in permanent molars, especially the third molar, in both dental arches (8).

The aim of this report is to present the successful management of biradicular maxillary central incisor using CBCT as an adjacent diagnostic tool.

2. Case report

The authors clarify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other documents to be reported in the journal. The patient was aware that her name nor any personal demographic information will not be published that may reveal her identity. This case is reported with approval from ethics

committee with the code of IR.SSU.DENTISTRY.REC.1402.004 and with patient's informed consent.

A 36-year-old female patient was referred to the dental clinic of Yazd Dental, for root canal treatment of the right maxillary central incisor (#8) due to suspicion of complicated root anatomy. No complications or difficulties were reported in the patient's medical or dental history. The tooth showed prolonged and severe reaction to thermal tests and percussion test was negative in comparison with control teeth. Pulp sensibility sensitivity tests showed irreversible pulpitis and normal periapical status. In clinical examinations, the crown of the tooth had a normal shape, and the periodontal status was normal. Regarding the tooth count, the number of teeth was found to be normal, and the presence of fusion or gemination was rejected. In radiographic examination using bisecting angle technique at different angles, the presence of a second root was confirmed based on the Same Lingual Opposite Buccal (SLOB) rule (Figure 1, 2).



Figure 1. Preoperative radiograph (A) frontal view, (B) mesial angle.

Next, cone-beam computed tomography (Planmeca, Helsinki, Finland) was performed for a more detailed examination of the root canal anatomy and to examine anatomical variations (Figure 3, 4).

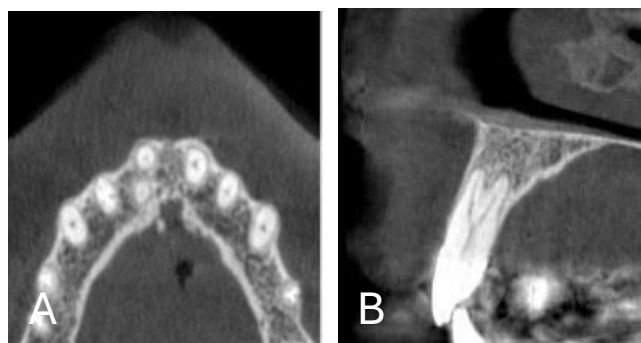


Figure 2. (A) CBCT horizontal view, (B) CBCT sagittal view.

Following the administration of one 1.8 ml cartridge of lidocaine 2% with 1/100000 epinephrine (Persocaine 2%, Daroupakhsh, Tehran, Iran) (isolation was performed with a rubber dam), an access cavity was prepared with a long cylindrical flat end diamond bur (Teeskavan, Tehran, Iran) under air-water spray cooling. According to the palatal position of the second root, the access cavity was extended toward the palatal surface. Next, using a rotary orifice shaper file (Dentsply; Maillefer, Baillaigues, Switzerland), the coronal third of the root was prepared for the root canal treatment, using the Crown-Down technique. Subsequently, the canal was negotiated with a No. 15 k-file (Mani, Tokyo, Japan). After finding the canals, the working length was determined with a Root ZX Apex Locator (J Morita Corp; Kyoto, Japan) and confirmed via periapical radiography.

After preparing the canals manually with k-files up to size 20 (Mani, Tokyo, Japan), the Crown-Down technique was used with rotary files up to F2 (Dentsply; Maillefer, Baillaigues, Switzerland) and 2.5% sodium hypochlorite was used for irrigation (Av, Yazd, Iran). Next, the canals were irrigated with 17% EDTA solution (Av, Yazd, Iran) for three minutes and then 2.5% sodium hypochlorite (Av, Yazd, Iran) for one minute to remove the smear layer; finally, normal saline (Samen PharmCo, Mashhad, Iran) was used for irrigating the canals. The canals were subsequently dried with sterile paper points (Meta-Biomed, Chungcheongbuk-do, South Korea), filled with lateral obturation technique using 2% gutta percha (Meta-Biomed, Chungcheongbuk-do, South Korea), and AH26 sealer (Dentsply; Maillefer, Baillaigues, Switzerland). The patient was finally referred for restorative treatment and after a 1-year follow up, the patient was asymptomatic and radiograph examination showed no periapical signs (Fig 5, 6, 7, 8).

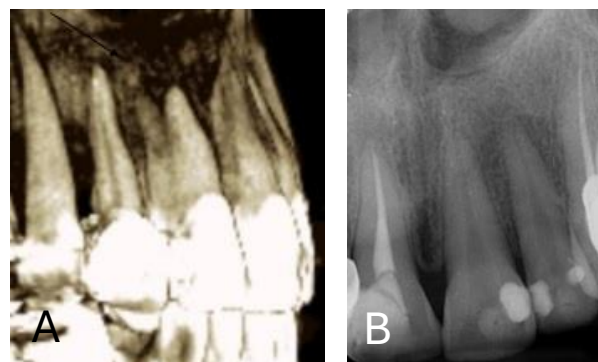


Figure 3. (A) CBCT 3-dimensional view, (B) postoperative radiograph, frontal view.

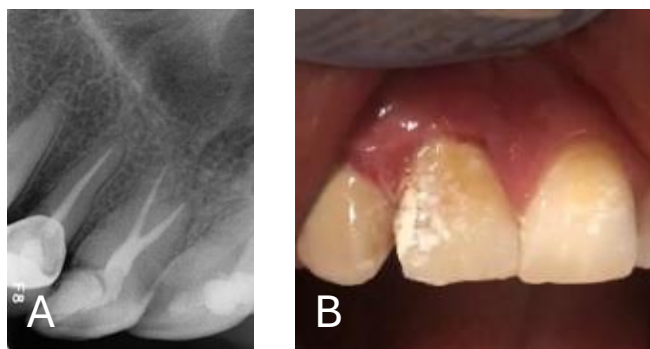


Figure 3. (A) postoperative radiograph, mesial angle, (B) Clinical intra-oral view.

3. Discussion

An electronic systematic survey is made using the PubMed internet website in an attempt to find articles that were published from 2010 to 2023 regarding maxillary incisors and their unusual morphology. The MESH terms used in the search were as follows: (two canal maxillary incisor), AND (three canals maxillary incisor), OR (maxillary incisor with multiple canals), OR (unusual maxillary incisor). Eleven relevant research were identified. The total number of treated teeth was 13 over a 13 years period, indicating the scarcity of multiple canals in the maxillary central incisor. 61% of articles reported two roots in the maxillary central incisor and 38% of articles published with two canals. The list of articles published from 2010 to 2023 is listed in Table 1.

Table 1. Articles related to multiple canals in the maxillary central incisor.

Authors	Year	Number of root/ canals
Nabavizadeh et al. (9)	2010	2/2
Jain et al. (10)	2013	1/2
Maghsoudlou et al. (11)	2013	2/2
Sharma et al. (12)	2014	2/2
Garlapati et al. (13)	2014	2/2
Kavitha et al. (14)	2014	1/2
		1/2
Miranda Candeiro et al. (15)	2019	2/2
Zhang et al. (16)	2021	2/2
Keerthana et al. (17)	2021	1/2
		1/2
Jafari et al. (18)	2022	2/2
Mahadevan et al. (19)	2023	2/2

The occurrence of two roots and two canals is rare in maxillary incisors. Today, with major advances in dentistry, such as Dental Operating Microscope (DOM), CBCT, and investigation of anatomical root canal variations, such cases have become more common (11, 21, 22). Besides, some anatomical anomalies, such as fusion, germination, and dens invaginatus, caused by anomalies in the development of Hertwig's root sheath, are possible (2, 8).

Regarding fusion and gemination, it is useful to determine the number of teeth for diagnosis. Besides, radiographic examination of teeth is helpful in distinguishing these two anomalies (23). In terms of dens invaginatus, the highest incidence has been reported in the lateral maxillary teeth, followed by the central maxillary teeth and rarely premolars and canines (24-26). Research suggests that dens invaginatus is usually observed as an abnormality of the tooth crown, which is wider mesiobuccally than labiolingually (27, 28).

Generally, pulp sensitivity tests in the absence of pulp necrosis, despite the presence of a periapical lesion, CBCT examinations, and radiographic analyses contribute to the diagnosis of this abnormality (29, 30). In the present study, considering the clinical presentation of the adjacent central tooth, the anatomical crown was normal, and periapical radiographic examination and CBCT results confirmed the existence of two separate roots with an anatomical crown. It should be noted that the familiarization of dentists with the anatomy of the root canal and anatomical variations, besides ensuring the number of root canals and the existing roots for endodontic treatments, is essential in root canal treatments. This case report was prepared according to the PRICE 2020 Guidelines.

4. Conclusion

This study indicated the importance of familiarizing dentists with the anatomical variations of the root canal and highlighted the significance of using the available techniques, including dental operative microscope and CBCT, to diagnose anomalies and improve root canal treatment quality.

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Authors' contribution

Alireza Yazdani Rostam: Conceptualization, Methodology, Validation, Investigation, Supervision
 Ali Emamian: Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization
 Nazanin Nasr: Resources

Conflict of Interest

The authors declare no conflict of interest.

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