Case Report

Endodontic Management of Permanent Mandibular Teeth having Rare Morphological Variations in Root Canal Anatomy—A Case Report

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Abstract

By completing an optimal root canal treatment, endodontic therapy aims to repair the damaged periapical area by removing microorganisms and their by-products from the infected root canal space. Nonetheless, a number of variables, such as understanding the architecture of root canals, precise diagnosis and treatment planning, and subsequent management of any anatomical variation in the affected tooth, all have a significant impact on the outcome of an endodontic procedure. There may always be differences, even though research indicates that most permanent human dentition has a similar root canal architecture. Therefore, it is critical to detect these morphological changes since failing to do so might have unfavorable effects and affect how well the medication is administered. Ignorance of anatomical variance, leading to a missing canal, is one of the most frequent causes of endodontic failure. In this case study, uncommon clinical symptoms in mandibular teeth—which are typically single-rooted—are discussed along with the endodontic treatment that followed.

Keywords: *Anatomical aberrations, endodontic therapy, mandibular canine, mandibular premolar, root canal variations, three root canal*

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Introduction

Endodontic therapy is the process of treating a necrotic dental pulp to preserve the structure, function, and aesthetics of a natural tooth that might otherwise be affected by infection.[1] An appropriate access aperture, chemo-mechanical preparation, and 3D obturation to create a hermetic seal and avoid reinfection are all necessary for a perfect root canal treatment. However, a thorough grasp of the complex internal anatomy of the tooth in question is also necessary. Literatures demonstrate that whereas single-rooted permanent mandibular teeth typically have a single root canal, anomalies may sometimes arise due to the existence of an additional root or canal. 95.4% of permanent mandibular canines have a single root and single canal, according to earlier research.[2-5] However, in 9.5% of documented instances, there is an occurrence of two separate canals inside a single root. When an additional root canal is present in a tooth that is only partially rooted, the canal arrangement is primarily Vertucci Type II (2-1) or Vertucci Type III (1-2-1).[6,7] Similar changes in root canal morphology, primarily in the apical third, have been described for permanent mandibular premolar teeth. While only 0.1% of instances have been documented to have three distinct roots or canals, but however, 0.5% of these teeth do exhibit the presence of two distinct roots with two canals.[7]

Therefore, the goal of this case series is to describe and discuss the management of morphological changes in the root canal architecture of mandibular teeth, which are typically single-rooted, that are discovered during routine endodontic procedures.

Case 1

The primary complaint of a 31-year-old man that reported at Saraswati Dental College and Hospital, Lucknow was discomfort and food lodgment in

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the lower front tooth. The patient was seen in the Department of Conservative Dentistry and endodontics. The patient provided no pertinent medical background. Upon clinical examination, tooth no. #43 had severe proximal dental caries. The tooth responded to the stimulus in the electric pulp test with an excessive reaction and to percussion with a normal response. An extraoral examination revealed no abnormalities. In tooth no. #43, a preoperative intraoral periapical radiograph (IOPA) revealed coronal radiolucency including pulp. Two separate canals were found in a single root when diagnostic IOPAs were obtained at various angulations.

The procedure was carried out after obtaining patient informed consent with form no.- 536006/23 under a 2.5x magnification. Using a high-speed air-rotor handpiece (NSK, Japan) equipped with an Endo-access and Endo-Z bur (Dentsply Maillefer, Switzerland) and enough water cooling, an access cavity was created. Using the DG-16 endodontic explorer (Dentsply, Switzerland), a single canal orifice was found. In contrast to the typical anatomy (Vertucci Type I (1-1)), which is most frequently observed, IOPA revealed a single canal orifice and a root canal that later divided into two canals (lingual and buccal) at the middle third of the root and then joined at the apical third before exiting at the apex (Vertucci Type III (1-2-1)) [Figures 1 and 2].

Case 2

The main complaint of a 35-year-old man who arrived at the department was discomfort in his lower right back tooth. The patient described having restorative work done on tooth no. #45 two to three months before. Upon clinical assessment, tooth no. #45's cold-cure resin restoration was found to be defective. There were no unusual extraoral findings, and the tooth responded to percussion in a typical manner. IOPA radiographic investigation indicated pulp radiolucency. To enhance the understanding of root canal morphology, radiographs were obtained at various angles of view. The branching of the root at the cervical third was an uncommon observation. To properly diagnose anatomical changes in the root and root canal morphology, the patient was suggested to get a CBCT scan, but he refused. Therefore, the patient was recommended to have the tooth root canal treated based on the results of the clinical, radiographic, and dental history examinations. The patient completed an informed consent form no. 563888/24 before treatment could begin. After the access cavity was prepared under rubber dam isolation, two canal orifices—one buccal and the other lingual—were found. Moreover, IOPA demonstrated the existence of a single canal towards the lingual side of the tooth and two distinct canals, mesial and distal, towards the buccal side [Figures 3 and 4].

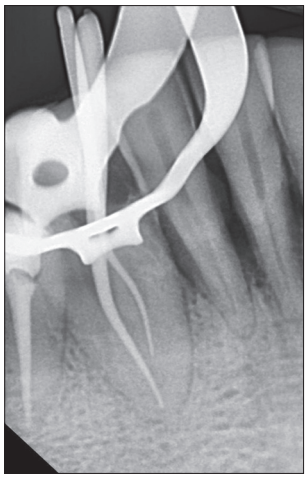

Figure 1: Master cone radiograph wrt #43

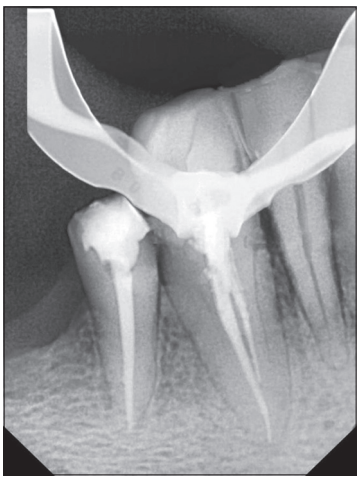

Figure 2: Obturated buccal and lingual canal wrt #43

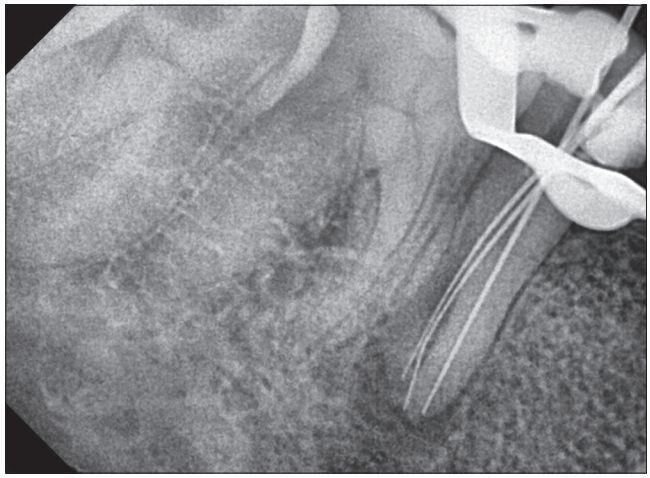

Figure 3: Working length determination using ISO size 10 K file in mesiobuccal, distobuccal, and lingual canal wrt #45

Discussion

Because root canal morphology varies so much, it is essential to understand root canal anatomy in endodontic

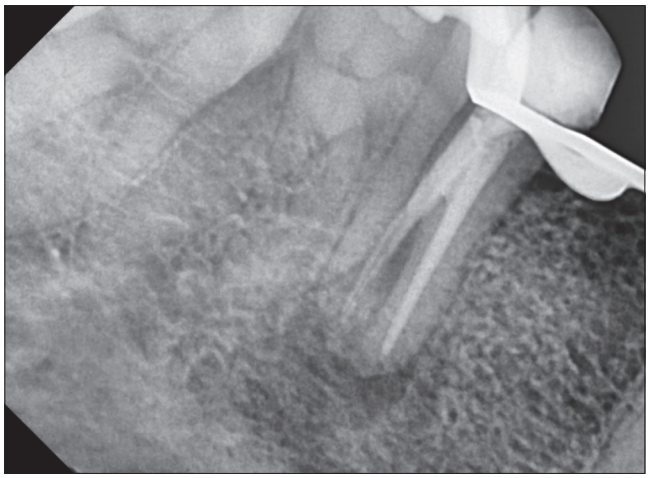

Figure 4: Obturated root canals wrt #45

treatment. In addition to the main root canal, the complex root canal system also consists of isthmuses, fins, auxiliary canals, lateral canals, and apical ramifications.[1] To successfully find and treat the entire root canal system, clinicians need to employ a variety of technologies. Preoperative intraoral periapical (IOPA) radiographs, both straight and multiple angled, are crucial for revealing the number of existing root canals. Apart from radiography, further diagnostic tools include fiber optic illumination for identifying anatomical landmarks in the pulp chamber, dyes to identify additional canals, and magnifying loupes.[2,8]

An accessory canal may be seen during an IOPA examination if there is a rapid shift in radiographic density or an unexpected constriction of the root canal space. The "tube shift technique" is useful in identifying and visualizing extra canals, especially in cases when canal orifices are overlapping or hard to see. Nevertheless, standard IOPA may not always be enough to identify morphological differences in the root canal system, requiring the use of further diagnostic tools. Contrary to intraoral radiography, cone-beam computed tomography (CBCT) is a sophisticated imaging method that produces higher-resolution, high-quality 3D pictures at a greater radiation dosage. A CBCT scan for small to medium-sized scanning areas has a radiation dosage range of 18–50 μSv, while the radiation dose for a single IOPA is between 1 and 8 μSv.[3,4] Therefore, intraoral radiographs are more often employed in routine dental practice owing to the increased radiation dosage of CBCT.[5]

Permanent mandibular single-rooted teeth usually have one canal; however, there may be differences in the shape of the root and the canal morphology. When periodontal vessels are trapped during calcification by Hertwig's epithelial root sheath (HERS), it leads to formation of accessory canals during embryonic development. Therefore, the creation of supplementary canals may be due to entrapment of blood vessels reaching the pulp as a result of localized failure in HERS formation.[6,7]

Conclusion

Determining the existence of any variations in the anatomy and morphology of the root canal is essential for the best possible result from endodontic treatment. To aid in the diagnosis and treatment of additional roots and/or root canals, if present, the clinician should meticulously interpret the radiographic findings, carefully inspect the pulp chamber floor, adjust the access preparation as needed, and, when necessary, adjust the file location and angulation within the canal space.

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Conflicts of interest

There are no conflicts of interest.

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