



CONQUERING THE ENIGMA: A CASE REPORT OF MANDIBULAR PREMOLAR WITH THREE CANALS

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ABSTRACT The ultimate outcome expected from a root canal treatment is thorough mechanical and chemical debridement of the entire pulp cavity and complete obturation with an inert biocompatible material followed by coronal filling which provides a seal against the ingress of microorganisms. These objectives can only be achieved by analysing and identifying the anatomical variations of the tooth under treatment. One of the vital causes leading to failure of root canal treatment is the inadequate knowledge about the internal anatomy of the pulp space in the root canals. One of the most common aetiologies leading to the failure of endodontic treatment are missed canals, and for this reason the clinicians should be aware of all types of variations that may exist in the root canal system of each tooth. While observing and analysing the root canals, it is very important to examine their arrangement, path, and shape, and to attain a comprehensive understanding of the root canal system's configuration, Vertucci's classification is recommended. To identify any deviations from typical dental anatomy, various supplemental methods have been suggested. A male patient was referred to us for the endodontic treatment in mandibular right second premolar from another clinic for the treatment. The premolar suggested complex "Y" shaped canal configuration. The entire treatment was completed in two visits along with adequate magnification and illumination.

KEYWORDS :

INTRODUCTION

The ultimate outcome expected from a root canal treatment is thorough mechanical and chemical debridement of the entire pulp cavity and complete obturation with an inert biocompatible material followed by coronal filling which provides a seal against the ingress of microorganisms.⁽¹⁾ As it is popularly known that, well begun is half done, in case of a root canal treatment, its successful outcome is largely based on a clear understanding of the internal anatomy of the tooth. This thorough knowledge of internal anatomy, would aid to gain proper access cavity preparation, that helps in thorough cleaning, shaping, disinfection and obturation of the pulp space. For these objectives to be accomplished, proper analysis and identification of the anatomical variations of the tooth under treatment, is must. One of the important factors contributing to the failure of root canal treatment is the inadequate knowledge about the internal anatomy of the tooth. (2) There have been reports documented which suggest various reasons for the failure of endodontic treatment one of them being related to insufficient cleaning and shaping, lack of apical and coronal seal due to improper obturation and faulty coronal restoration respectively, and failure to recognise accessory canals which leads to incomplete treatment and high risk of reinfection. (3) One of the most common aetiologies leading to the failure of endodontic treatment are missed canals, and for this reason the clinicians should be aware of all types of variations that may exist in the root canal system of each tooth. Vertucci (2005) had classified morphological patterns of the root canal systems into eight different types. According to him, in the simplest form, each root has a single canal and a single apical foramen (type I). Others include, canal complexities that exit the root as one, two, or more apical canals (types II–VIII). Commonly, the mandibular second premolars have a single root and a single canal (Vertucci type I; 99.28% and 86.9%, respectively). (4) While observing and analysing the root canals, it is very important to examine their arrangement, path, and shape, and to attain a comprehensive understanding of the root canal system's configuration, Vertucci's classification is recommended. This classification system analyses anatomic variations and along with this also categorizes the configuration of root canals (Sierra-Cristancho *et al.*, 2021). Although, this classification system does not provide all root details, it remains applicable for determining the number and general configuration of root canals in most of the cases. To identify any deviations from typical dental anatomy, various supplemental methods have been suggested to assess root canal anatomy, including conventional radiography (utilizing

retro-alveolar radiographs with varying angles) and cone-beam computed radiography (CBCT), which provides a three-dimensional image of the entire root canal system's morphology. In both cases, it is advised to thoroughly evaluate radiological images to identify any potential abnormalities. (5)

Case Presentation

A patient was referred to us for the endodontic treatment in mandibular right second premolar.

The patient had been referred here, from another clinic, where he had first visited. The doctor there being a general dental practitioner, felt the need for an expert intervention by an Endodontist, after assessing the complex anatomy of the root canal.

On radiographical examination, as shown in figure 1, the premolar suggested complex "Y" shaped canal configuration. On examining clinically tooth was having some cotton filled in access cavity as the treatment was attempted at the previous clinic. Upon asking about the history of pain, patient described the pain as continuous, mild, dull, aching one. Along with this, neither any aggravating nor relieving factors could be identified.

Thus, compiling the clinical examination, radiographic findings and patient's history, the condition was diagnosed as pulpal necrosis with asymptomatic apical periodontitis, as per the guidelines by AAE, 2013

Further treatment was carried out at our clinic.

The entire treatment was completed in two visits along with magnification (Carl Zeiss OPMI Microscope) and illumination.

In the first visit, proper isolation was obtained with the help of rubber dam (Coltene) and then the access cavity was modified as shown in figure 2. As the root canal was already initiated, the access to the canals had already been obtained but yet the cavity needed modification. Proper deroofing was done using Endo-Z bur (Dentsply) and adequate access cavity was prepared keeping into consideration the principles of conservative cavity as well as a straight line access.

With the help of an apex locator (Root ZX Mini, J Morita), working length for all the 3 canals was recorded and the same was verified with

the help of a radiograph (Figure 3). Following this, the biomechanical preparation of taper 4% was done at using NeoEndo Flex system, till 30/0.4 (Mesio buccal and Mesio lingual canals) and 35/0.4 (Distal canal) dimension.

Chemico-mechanical debridement was carried out with 5.25% Sodium Hypochlorite (Cerakmed), liquid EDTA (Orikam) and Normal Saline, using side vented needle (ident). Intracanal sodium hypochlorite was heated with elements unit at 150°C which was then activated using the activator (Glin).

At the end of the first visit, calcium hydroxide (Orikam) dressing was placed inside the canal and the access cavity was sealed with a temporary cement.

The patient was recalled after 7 days for the obturation of the root canals and post root canal restoration. A radiograph was recorded to verify the length and apical tug-back of the master cone gutta percha as per the working length and the biomechanical preparation (Figure 4). The obturation of the root canals was done using single one technique. The sealer used was Biomed Ceraseal (Meta Biomed). The canals were first coated with the sealer using a lentulospiral and the sealer coated respective gutta percha was used to obturate the canals (Figure 5). The post endodontic restoration was completed using the Spectrum Composite (Dentsply Sirona).

The post-operative radiograph was recorded as shown in the figure 6.

For the prosthetic part, the patient was referred back to the dental practitioner who had referred to us.



Figure 1: Pre-operative Radiograph

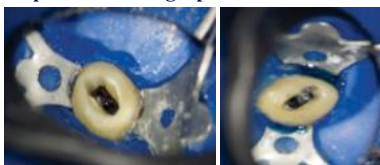


Figure 2: Access Cavity



Figure 3: Radiograph of the Working Length



Figure 4: Radiograph of the Master Cone



Figure 5: Radiograph of the Sealed Root Canals



Figure 6: Post-operative Radiograph

DISCUSSION

Correct diagnosis is one of the prime requirements in dentistry in general, and especially for endodontics in particular. (6)

As per the literature, mandibular premolars can pose as the most difficult teeth for endodontic treatment. This factor can be attributed to variations in the internal anatomy like, presence of multiple root

canals, apical deltas and lateral canals. Numerous studies have assessed the root canal morphology of mandibular premolars and have documented that mandibular first premolars usually have one canal (67-86%). But, however, in 15-25% of cases two canals are present and three canals have been reported in mandibular first premolars in 0-33% of cases. As far as the mandibular second premolar is concerned, the incidence of two and three canals is less than mandibular first premolars. The incidence of three canals in mandibular second premolars has been stated to be about 0-8%. According to the literature documented by Rahimi et al., the incidence of three canals in mandibular first and second premolars were 1.2% and 0%, respectively. Vertucci, reported the incidence of three canals in mandibular first and second premolars to be 0.5 and 0% of cases, respectively. Whereas, Pineda and Kuttler have reported three canals in mandibular first and second premolars in 0.9% and 0%, respectively. Additionally, Caliskan et al. showed that the incidence of three canals in mandibular first and second premolars were 5.7% and 0%, respectively. Another investigators, Zillich and Dowson have inferred that the incidence of, both, three-canalled mandibular first and second premolars were 0.4%.(7)

Rahimi et al. has stated that the incidence of lateral canal to be around 38.7% and apical delta to be 4.38% in mandibular premolars. However, the frequency of 3 or 4 canals in lower premolar teeth reported was less. Llena et al. reported that mandibular second premolar canal configurations according to the Vertucci criteria are 90.6% type 1, 1.8% type 2, 7.5% type 5, and 0.0% type 6. As a result, most teeth were reported to be type 1 followed by type 5. (8)

Despite of the above statistics which suggests that the incidence of three canals in mandibular second premolar is very less to negligible, the case presentation under discussion exhibited three canals in mandibular second premolar. The tooth under study presents Vertucci Type VIII classification. (8)

The mandibular second premolar is considered to be one of the most difficult teeth for endodontic treatment, due to the chances of multiple variations in the morphology of its root canal system. (8)

If these morphological challenges are not considered during the treatment, it can lead to post-treatment complications, failure or flare-ups. (9) The reason behind such failures could be attributed to the complex anatomy of the root canal which makes the entire process of the biomechanical and chemico-mechanical preparation very challenging. As a consequence of the incomplete root canal preparation or missed root canals may often lead to the retention of microorganisms, which in turn may cause or exacerbate the infection of peri-apical region. Karabucak et al. inferred that teeth with missing root canals are 4.38 times more likely to develop pathological changes compared to normal teeth. A significant finding documented suggests that among molars and premolars that develop apical periodontitis after the completion of root canal therapy, the incidence of missing root canals is 83%. In relation to this inference, premolars exhibit a relatively higher proportion of missing root canals among teeth with apical periodontitis following a root canal therapy, with the highest reported proportion reaching 43%. (10)

In our case there are three canals found in the mandibular second premolar, for which the data suggests that to identify such case, the cervical half of the root is generally wider than usual, with little or no taper. Also, two periodontal ligament spaces on one side of a root and the periodontal ligament space crossing over roots are important observations to indicate the existence of accessory roots. Magnification and illumination have always been the key factors in such challenging cases in endodontics. A magnifying device or loupes used during interpretation of radiographs could allow for visualization of some unseen details. (11)

In such cases, careful clinical examination can aid the clinician with signs that are typical of the presence of a third root. Probing can help identify the presence of a buccal furcation; sometimes a small depression can be present, starting from the buccal roots furcation and proceeding in a coronal direction for a few millimeters. The use of magnification and fiber optic illumination offers a tremendous advantage in locating and treating extra canals. The surgical operating microscope has been found to be particularly helpful, mainly localized in the cervical third of the tooth crown (7)

Fortunately, the patient was referred timely for the endodontic

intervention and thus with the help of correct protocol and step by step procedure from diagnosis to identifying the anatomical variation including the treatment procedure methods required in such cases, required outcome was achieved.

CONCLUSION

It can be inferred that detailed examination of the pre-operative radiograph and thorough clinical knowledge is inevitable for the successful outcome of the endodontic treatment, especially in cases where the teeth exhibit complex and challenging internal anatomy.

Thus, timely diagnosis, proper identification of the internal anatomy of the tooth, using proper magnification and illumination along-with adequate measures to efficiently treat the variant, desired post-treatment result can be obtained.

Along-with these timely intervention by the relevant specialist is also a correct line of approach for efficient treatment deliverance.

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