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Endodontic Treatment of a Mandibular Canine with Two Separate Roots and Root Canals: A Case Report

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Abstract Anatomical variation in the number of roots and root canals can occur in any tooth. Aberrant morphology of the root canal system may hinder cleaning and shaping procedures, leading to failure of endodontic treatment. The aim of this paper is to show one an example of root canal anatomical variation. Mandibular canines usually have one root with a centrally located root canal; however, anatomical variation may also exist. In this case report, the author described the successful endodontic treatment of a mandibular canine with two separate roots and root canals.

Keywords Abnormal Anatomy, Mandibular Canine, Root Canal Treatment

1. Introduction

Variations in root canal morphology are a constant challenge for diagnosis and successful endodontic therapy. Root canal treatment can be highly guaranteed when all root canals are identified, thoroughly cleaned and shaped, and obturated with an inert filling material [1]. The clinician should form a mental picture of the pulp spaces from the coronal aspect to the apical foramen and should always be aware of common internal root morphology and possible variations which might be encountered. If disregarded, these anatomical anomalies may complicate endodontic treatment and compromise therapy outcomes [2,3].

Several studies investigated the internal anatomy of mandibular canines[4-7]. The basic anatomy comprised of a single rooted tooth with a large ovoid single root canal that is centrally located. However, certain internal and external morphological variations in the mandibular canine have been reported in the literature. Vertucci [5] reported the presence of a second radicular canal with one or two apices in 15% of the studied cases . The occurrence of two canals and even more two roots is rare, ranging from 1% [5] to 5%[8].

Endodontic treatment of two-rooted mandibular canine have been documented in several clinical reports [9-11]. Also two distinct case reports of mandibular canine with three canals in one root[12], or three canals in two roots [13] were reported in the past. All of these cases suggest abnormal development of the tooth and root.

Mandibular canines do not always display the basic expected anatomy. Despite the low prevalence, clinicians should consider possible variations in the number of roots and root canals. This paper reports the case of a patient with mandibular canines with two separate roots and two root canals.

2. Case Report

A 23-year old medically fit Palestinian female patient was reported to the Department of Conservative Dentistry & Endodontics suffering from severe pain in her lower right anterior region. The chief complaint of the patient was “Sharp lingering pain upon cold stimulus, sometimes the pain was spontaneous and awakened her at night”. Clinical examination revealed a mandibular right canine with extensive proximal caries. The tooth was tender to percussion. There was no mobility, and probing with a periodontal probe did not reveal any periodontal pocket. Vitality tests on the involved teeth showed abnormal responses (lingering pain to cold, increased reaction at Electrical Pulp Test). Pre-operative radiographs revealed deep proximal caries encroaching the pulp with two roots and two root canals (Fig.1).

Figure 1. preoperative radiograph of mandibular canine showing two separated roots.

The diagnosis of irreversible pulpitis was made for the right mandibular canine and nonsurgical root canal treatment was scheduled for the involved tooth.

After the administration of the local anesthetic (Lidocaine HCL 2% with Epinephrine 1:100,000) and under rubber dam isolation, caries was removed and the pulp chamber was accessed. To gain sufficient access to the canals, the conventional lingual access opening was modified into one that included more the incisal surface. On entry into the pulp chamber, two main orifices were found: one lingually and one buccaly. Coronal flaring was carried out using the Sx file of the ProTaper system (Dentsply, Maillefer, Ballaigues, Switzerland). The two canals were carefully instrumented with a size 10 K-file (Dentsply, Maillefer, Ballaigues, Switzerland). The working length of the located canals was established with the use of an apex locator (Root ZX; J Morita Co, Kyoto, Japan) and verified by taking a radiograph (Fig. 2). Both canals were instrumented to an apical size 20 by hand files to create a glide path. Individual canal flaring was performed with ProTaper (Dentsply, Maillefer, Ballaigues, Switzerland) rotary NiTi files. During instrumentation, copious irrigation was performed with 2.5% sodium hypochlorite. All canals were prepared to a size F2 file. After completion of the chemomechanical preparation, root canals were dried with sterile paper points and then obturated using System B (Analytic technology, Redmont, WA, USA) and Obtura III (Obtura Corporation, Fenton, MO, USA). AH plus (Dentsply DeTrey, Konstanz, Germany) was used as a sealer. A post- operative radiograph was taken (Fig. 3) which showed a satisfactory obturation. After one week, the patient was asymptomatic and a final restoration was performed.

Figure 2. working length measurement radiograph with two K-files in two separate roots.

3. Discussion

Morphologic variation in the anatomy of any root canal system should always be considered at the beginning of root canal treatment. Each case, independent of the type of tooth, should be examined clinically and radiographically in a thorough manner to detect possible anatomic variations.

It is generally accepted that a major cause of root canal treatment failure is the inability to locate and adequately disinfect all of canals of the root canal system [14]. Studies have shown that unprepared areas of the root canal system may harbor bacteria and necrotic tissue that may result in root canal treatment failure [15]. In a statistical analysis of re-treatment cases, Allen et al [16] analyzed a total of 1300 endodontic subjects for factors that may have contributed to the failure of the original treatment and reported that untreated canals were responsible for failure in 114 cases, with 8.8% prevalence.

The mandibular canine is commonly described in the endodontic literature as a single rooted tooth with a single root canal system [5]. However, the presence of two roots in mandibular canines is rarely observed. In a previous study using a tooth clearing method, Pecora et al [6] studied the internal anatomy, direction and number of roots of 830 extracted human mandibular canines and showed that 98.3% of these teeth presented a single root, 1.2% with two canals and two foramina and only 1.7% of the canines had two roots and two root canals. In another study, Bakianian et al [17] analyzed 100 canines by making transversal slices on them. Using the stereomicroscope, he detected the presence of two root canals in 12% of teeth. An even higher incidence (18.5%) of two canals was found by Pineda and Kuttler [4] who used radiographic images to study the internal morphology of 187 mandibular canines.

Figure 3. postoperative radiograph. Two separate roots are filled with gutta percha and sealer.

Radiographic examination is an essential part of endodontic management, from initial diagnosis to monitoring treatment results. Although periapical radiographs provides two-dimensional images of three-dimensional objects, their interpretation reveal internal and external details that may suggest an extra canal /and or root [18] and provides much needed information about root canal morphology especially if taken from different horizontal angles [19]. Martinez-Lozano et al [20]

found that by varying the horizontal angle of about 20 and 40 degrees, the number of root canals observed coincided with the actual number of canals present. Mandibular canines with two roots are not difficult to identify by careful examination of the diagnostic radiographs taken with parallel and mesial or distal horizontal angle techniques. In the presented case, unusual root shape was clearly observed in pretreatment radiographs, which recommended the possibility of a second root and canal. However, it does not always occur. Identification of the second root is even more difficult in the presence of tooth crowding. Therefore, the radiographic image should be carefully analyzed in order to interpret and identify details that may suggest the presence of bifurcations or trifurcations, such as sudden root canal discontinuity [21].

Although the dental operating microscope (DOM) was not used in this clinical case, it's use is recommended in routine endodontic practice as it offers excellent illumination and magnification to the operating field and provides tremendous advantage in locating and treating 'extra' canals. Studies have shown that when the operator uses an operating microscope regularly to locate canals, the prevalence of detection of additional canals increased to 93% [22].

Proper access cavity preparation is vital for successful identification and instrumentation of extra root canals. Properly designed and prepared access cavities will eliminate many potential problems during canal preparation and obturation. In this case, instead of doing the traditional lingual entry, a modified wide incisal access preparation allowed for a clear view of the pulp chamber floor that showed the presence of two bleeding points. Other diagnostic aids for canal location include staining the pulpal floor with opthalmic dyes, transillumination or performing the champagne or bubble test with warmed 2.6% Naocl as suggested by Ruddle [23].

To conclude, the thorough knowledge of root canal anatomy and its variations, careful interpretation of radiographs, close clinical inspection of the floor of the chamber and proper modification of access opening along with adequate magnification are essential elements for a successful and reliable treatment outcome.

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