CASE REPORT

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A rare variant of internal anatomy of a third mandibular molar: a case report

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Abstract

The several anatomical variations existing in the root canal system may contribute to failure of the root canal therapy. Knowledge of the internal dental morphology is a complex and extremely important point for planning and performing endodontic therapy. This paper reports the case of a left mandibular third molar that presented only one dental conical root and only one aberrant radicular canal with an initial annular portion situated in the coronar third of the root and a linear portion at the level of the other two thirds of the dental root, which opened through an apical foramen. Root canal therapy and case management are described. Features like wide crown access, adequate illumination and use of exploring files where important for successful completion of the endodontic treatment. The treatment was performed through conventional methods. This clinical case constitutes a rare anatomical variant of internal radicular morphology.

Keywords: endodontic treatment, internal anatomy, third mandibular molar.

Introduction

The main objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp space followed by a root canal filling.

The pulp cavity is situated in the centre of the tooth, it is divided into the pulp chamber, and the radicular canals situated into the dental root. The radicular canal is a continuation of the pulp chamber. The openings of the radicular canal beside the tooth include the apical foramen and the accessory foramina, the latter being placed at the level of the pulp floor in a proportion of 8% and at the surface of the radicular furcations in a proportion of 64% [1].

Knowledge of the internal root morphology is a complex and extremely important point for planning and performing of endodontic therapy. Several anatomic variations existing in the root canal system may contribute to the failure of root canal therapy, mainly in teeth with pulp necrosis [2]. Therefore, it is imperative that aberrant anatomy is identified prior to and during root canal treatment of such teeth [3]. Lack in identification of all root canals has the result of a continuous discomfort for the patient and the possible appearance of some periapical symptoms.

Anatomic variations in any group of teeth, to any person and to any group of people are described in the traditional textbooks of dental anatomy, although there are studies that reported variable root canal configurations, except for the mandibular second premolar [4, 5].

The third mandibular molar presents considerable morphological radicular variations: it can have one or several roots whose form varies; it frequently has two roots, a mesial and a distal one, which often merge, and it usually displays two radicular canals [6]. Although the anatomy of third molars has been described as unpredictable, restorative, prosthetic, and orthodontic considerations often require endodontic treatment of third molars in order for them to be retained as functional components of the dental arch [7]. The pulp chamber and the radicular canals of the third mandibular molar are generally wider since the complete development takes place later than those of the first two molars. This difference can be noticed easily through dental radiographs performed on patients with ages between 15–35-year-old.

From an anatomical point of view, based on form and number, the radicular canals of a unique root have been divided by Weine FS into four classes [6, 8]. A more complete classification than the one made by Weine FS, based on the number of radicular canals and their way into the dental root from the floor of the pulp chamber up to the apex, is the classification of Vertucci FJ, which divides them into eight types [9].

Patient, Methods and Results

A 31-year-old Caucasian woman presented to the Oral Rehabilitation Department complaining of sensitivity to cold and beverages on the posterior tooth of the left mandibular arch. Oral examination revealed an advanced carious lesion on tooth 38* (* The World Dental Federation notation was used). Teeth 34, 36 and 37 were missing, while 35 and 38 had horizontally migrated, reaching the proximal contact (Figure 1). A history of extractions, 11–12 years ago, was confirmed by the patient. The initial radiograph showed a third mandibular molar with a unique conical root.

Loss of the teeth was a reason for considering the third molar as a strategic abutment. For this purpose,

we choose to preserve the pulp vitality. At the end of carious dentin excavation, an accidental opening of the pulp chamber occurred. Being small, without bleeding, we decided over the conservative treatment and we performed the direct pulp capping with calcium hydroxide and the sealing of the tooth with a temporary filling material (Figure 2).

Forty-eight hours later, the patient presented spontaneous pain exacerbated by cold, originating in the tooth 38. No sensitivity to percussion was present. A diagnosis of irreversible pulpitis was settled, which imposed as a method of treatment the vital pulp extirpation.

Local anesthetic was given and the operative field was isolated with a rubber dam. Access cavities were prepared, the pulp tissue was removed and the pulp cavity irrigated with 3% sodium hypochlorite solution.

At the level of the floor of the pulp chamber, we have tracked down after inspection and palpation with an explorer the presence of a foramen of around 2.5 mm diameter. Trying to obtain the patency of the root canals with the endodontic device, we discovered two different directions of endodontic access, directions that at a certain moment were overlapping. The working length was determined with the help of an apex finder.

After exploration, we assumed that we were dealing with a monoradicular molar with two radicular canals. The preparation forms of the radicular canal depend upon the technique of obturation that is going to be used. As we decided to perform the obturation of the canal with a sealer and a gutta percha point, we performed a uniform widening on the entire pre-established working length. In order to do this, we used the Protaper manual system (nickel-titanium files) of the Dentsply Maillefer company. We finished the endo-radicular preparation with the F3 needle, and the apical preparation was performed with the F2 needle. After each canal device used, the canal was irrigated and lubricated with 3% sodium hypochlorite solution and with a paste based on EDTA. At the end of the preparation, the canal was dried and filled with a paste of zinc oxide eugenol and gutta-percha point. The canal treatment was performed without the endodontic microscope, neither the access was modified nor another method of increasing the working area was used. The tooth was temporary sealed and the patient was referred for restorative treatment.

Postoperatory evolution was favorable without any subjective or objective symptoms. A final radiograph was taken to confirm the completeness and extension of the root filling. The radiograph has confirmed to us that the tooth presented only one aberrant radicular canal with an initial annular portion situated in the coronal third of the dental root and a linear portion at the level of the other two thirds, which opened through only one apical foramen (Figure 3).

Figure 1 – ***Initial radiograph.***

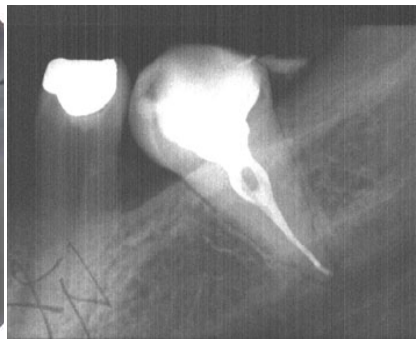

Figure 2 – ***The radiograph shows that the tooth was provisionally sealed.***

Figure 3 – ***Postoperative radiograph.***

Discussion

This clinical case represents a rare anatomical variant of internal root morphology identified in a third mandibular molar, correctly managed through conventional therapeutic methods. The type of root canal morphology encountered in this patient has never been described in association with a third monoradicular mandibular molar in any of the considered references. It is similar to the type III presented by Vertucci FJ, with the mention that in our case, the annular portion of the canal is situated at the level of the coronal third of the root, while Vertolucci described it near the apical third. The instrumentation of the canals was performed with nickel-titanium files because of their flexibility and lesser risks of step formation or perforation. The instrumentation technique used recommended a wide access to the middle and cervical thirds, which facilitated the cleaning of the apical third and the filling of the root canals [10].

The most frequent cause of endodontic failure is the apical percolation and subsequent diffusion stasis into the canal. The main reasons for this failure are incomplete canal obturation or an untreated canal. A canal is often left untreated because the dentist fails to recognize its presence [11]. Anatomic variations can be observed in every group of teeth, but those that do not follow the so-called "normality" are few and constitute an exception to the rule. Third molars, however, do not allow such anatomical classification due to the great morphologic variation observed. The dentist must be aware of this fact in order to provide correct treatment.

Ahmed HA *et al.* showed that the most common canal system configurations of permanent mandibular molars were type IV (73%) and type II (14%) [12].

After Gulabivala K *et al.*, 53% of the third mandibular molars have two separate roots. The majority (81–100%) of conical distal roots possess a simple type I (single canal) configuration, whilst the canal system of mesial roots is more complex: 52–85% contain two canals, of which type II (two orifices, one foramen) and type IV (two separate canals) are the most prevalent. The

majority of roots of all molars contain one or two apical foramina (91–96%) and the apical third has the highest prevalence of lateral canals. Single-rooted molars have a wide variety of canal system. Conical roots tend to have simple canal systems, whilst flatter/broader roots have more complex canal systems [13].

The root canal morphology of mandibular molars varies among population groups [14].

In another study involving 173 third mandibular molars, Gulabivala K *et al.* found two separate roots in 68% of them, fused roots in 20% and a single C-shaped root in 11%. The majority of the mandibular third molars had two canals in this study (61%) [15].

Guerisoli DMZ *et al.* found a great anatomical variability in the investigation of 269 third molars (155 maxillary and 114 mandibular). The mandibular third molar had two root canals (a mesial and a distal) in 69.3% of the cases. A mandibular third molar with three roots and another with an accessory root, which differs from the former due to its reduced size, were found. The length of the mandibular roots did not vary as much as the maxillary third molars. Guerisoli DMZ *et al.* consider that mandibular third molars may have one, two or three roots and up to three canals [16].

Sidow SJ *et al.* showed in their study that 17% percent of mandibular molars had one root (40% of which contained two canals), 77% had two roots, 5% had three roots, and 1% had four roots. Teeth with one root demonstrated the most unusual morphology, with the number of canals varying from one to six [7].

The variations in dental anatomy play an important role in root canal therapy. Accurate location of the aberrant canals depends on the use of magnification, adequate lighting and modified access. In case an aberrant canal is not found, the endodontic treatment might fail. In the presence of anatomical difficulties due to the pronounced curved canals, to the complexity of the apical system, to the multiple apical foramina or furcated canals, the endodontic treatments become a challenge.

Conclusions

A study of the canal morphology of third molars is suggested to provide the endodontic practitioner with an understanding of the clinical implications of root anatomy. A careful inspection of the pulp chamber floor allows the clinician to search the additional or aberrant canals. Dental clinicians should keep this possibility in mind whenever they perform endodontic treatment. When root canal treatment is to be performed, the clinician should be aware that root canal anatomy may be abnormal.

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