

CASE REPORT

Anatomical variation of mandibular second molar and its implications in endodontic treatment

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Abstract

The variations of anatomical and morphological characteristics of the teeth are very important for any practitioner. These differences in root morphology are influencing the success of the endodontic therapy and the long-term prognosis of the tooth, especially when it is an abutment for a prosthetic restoration. Before beginning an endodontic treatment, the clinician must take into account the morphological variations of the root anatomy. This article describes the therapeutic approach in a case of mandibular second molar with four canals abnormally located instead of three. This anatomical variation is a major risk for both endodontic and prosthetic treatment failure. The lack of knowledge of root and pulp anatomy permits the errors in diagnosing and treatment planning. Unfilled canals, left like this by omission, can compromise both the endodontic and prosthetic treatment. For the success of the any dental treatment is critical to know the normal configuration of the pulp and to be aware of the possible variations.

Keywords: root canal morphology, mandibular second molar, endodontic treatment, prosthetic treatment.

☐ Introduction

One of the most important issues in endodontics is the knowledge of internal root anatomy. This, together with an accurate diagnosis and a proper preparation of the canalicular system will lead to a successful endodontic treatment. Undetection of supplementary roots or even supplementary canals is the major reason in the failure of endodontic treatment [1].

Endodontic treatment success requires the understanding of the anatomy and morphology of dental canalicular system, and the clinician must be prepared to identify all those teeth that show an unusual anatomical configuration [2].

Physicians should be aware of the internal morphology of permanent teeth and of the possible anatomical variations that may occur. Internal anatomy of the teeth is not always similar. There are a great number of variations in the number and the shape of the roots. Many dentists are accustomed to treat teeth with a standard number of roots and roots canals. Hence, endodontic failure may result.

☐ Patient, Methods and Results

Patient D.C., 38-year-old female, came to the office for the restoration of the integrity of the lower arch. Following clinical and radiological examination (Figure 1), the restoration of the two absent lower

molars will require two porcelain-fused-to-metal bridges, the patient being partially edentulous (inferior Class III Kennedy with one modification). Because of the type of the occlusion and the inclination of the second molar, it was necessary to devitalize the future abutment teeth. The treatment started with the left side of the mandibular arch. Endodontic treatment was performed for 3.5 without any hindrance. At first sight, the mandibular second molar devitalization (3.7) should not have to raise any problems. This tooth usually is a biradicular tooth, having a mesial root with two canals and one distal root with only one root canal.

We started the treatment with administration of local anesthesia using articaine with adrenaline. The access was done through its occlusal surface with a spherical bur, at the site of choice; after that, it was done the removal of the pulp chamber ceiling and the removal of the crown pulp with an excavator (Figure 2).

Finding the orifices of the mesial canals was rather easy, but when trying to break into the distal canal, it is observed that it is not present into the distal root axis, as we expected, but has an eccentric position. After careful grooming of the resulting cavity, we can see on the floor of the pulpar chamber the existence of the four opening holes of root canals, two mesial and two distal roots belonging (Figure 3).

In the next stage, the mechanical treatment was performed in all the four canals, endo-canalicular cleansing being made with a lot of antiseptic substances

(hypochlorite), the final root sealing being made with a calcium based material-hydroxide and a gutta-percha cone (Figure 4).

At the end of the treatment, a porcelain-fused-to-

metal bridge was made with two-abutment teeth, 3.5 and 3.7. This bridge restores the integrity of mandibular dental arch and the occlusion, compensating the loss of the first mandibular molar (Figures 5 and 6).



Figure 1 – Initial panoramic X-ray.



Figure 2 – Getting access on occlusal surface.



Figure 3 – The holes of the four radicular canals.



Figure 4 – Endodontic treatment successfully done on 3.7.



Figure 5 – Final aspect of prosthetic restoration.



Figure 6 – Aspect of the bridge in occlusion.

Discussion

Mandibular molars play an important role in mastication and help maintain the vertical dimension of occlusion, ensure the dental arch continuity, and at the same time, they maintain the position of tongue and cheeks. Keeping them on the arch is very important for the prosthetic future of the patient, as these provide dento-parodontal support in the distal area of the mandibular arch. Therefore, their proper endodontic treatment allows their preservation on the arch and the preservation of the dental system's integrity.

Research has shown that the anatomy of the mandibular molars requires attention because the number of roots and root canals is highly variable. Numerous studies have been conducted on the anatomical variations of mandibular molars, both for the first and the second one, because their morphology is very similar.

Mandibular first molar usually present two roots with three radicular canals: two in the mesial root, and one large, oval in the distal root.

Different authors have studied the presence of four canals in the lower first molar, so the results obtained were as follows: Hess W [3], in 1925, analyzing a total of 512 of lower molars, observed the presence of four root canals in 4% of cases. Griffin J *et al.* [4], in 1969, in a study including 203 molars found a rate of 27.5%. Pineda F and Kuttler Y [5], in 1972, reported a rate of 27% after analysis of 300 molars; Vertucci FJ and Williams R (1974) [6] – 30%; Vande Voorde H *et al.* (1975) [7] – 31%; Hartwell G and Bellizzi R (1982) [8] – 35.1%; Fabra-Campos H (1985) [9] – 47.6%; Walker RT (1988) [10] – 45%; Yew SC and Chan K

(1993) [11] – 31.5%. The research of Skidmore AE and Bjorndal AM [12] showed that a third of these molars presented four radicular canals.

The mandibular second molar is very much alike the first molar, only the incidence of two canals in the distal root is much smaller. According to Vertucci FJ [13], the mandibular second molar is similar to the first one, except that the roots are shorter, the canals are more curved and the rate of anatomical variations is different. Usual anatomy of the mandibular second molar is with two roots: one mesial and a distal one. They usually are separated, but sometimes can merge forming a conical root, with varying internal anatomy, and sometimes can have a C-shaped configuration [14]. This form is usually seen in Asian populations. In some studies, it is shown that the mandibular second molar may submit three of four roots [15–18].

Manning SA [19] examined mandibular second molar and found that in 22% of cases it shows a single root, 76% have two roots and only 2% have three roots. In the group of those with two roots, most of them present one or two canals in the mesial root, which is joined before apex, and one canal in the distal root. About 25% of the mesial roots have two separate canals from the pulp chamber to the apex. These teeth have the typical triangular shape of the pulp chamber floor. Very often, in 64% of cases, the mesial root has two canals, about 38% of type II, and type IV – 26%. In the distal root we commonly find one independent single root canal (type I, 92%), type II (rare, 3%), and type IV (4%). Type I is represented by a tooth with a single canal which extends from the pulp chamber to the apex.

Type II represents a tooth with two separate canals that leave the pulp chamber and join near the apex. Type IV represents a tooth with two separate and distinct canals, which extends from pulp chamber to the apex.

Rocha LF *et al.* [20] studied external and internal anatomy of 628 mandibular first and second molars, second molar roots analysis showing that in 84.1% of cases, the molar presents two separated roots; in 15.9% of cases, the roots are fused and in 5% of the cases, there are three roots.

Anatomy of the mandibular second molar has racial variations. Using retroalveolar X-rays of 328 patients (105 of Mongolian origin, 106 blacks and 117 Caucasians), Ferraz JA and Pécora JD showed an incidence of a third root of 2.8% in patients of Mongolian origin, 1.8% for Black population and 1.7% in Caucasians [21]. It was reported a case of mandibular second molar with one root and one mandibular root canal [22]. Weine FS *et al.* [23] showed that mandibular second molar seems to have more anatomical variations than any other molar. Maggiore C *et al.* said that the second mandibular molar roots could range from one to three [24]. In certain circumstances, the root canals can be left untreated during the endodontic therapy, if the clinician is unable to detect their presence [25].

The examination of X-rays made from various angles and the clinical assessment of the internal anatomy of teeth is very important. In all the cases when the initial X-ray image shows an unusual anatomical structure it is recommended to take additional radiographs of the mesial or distal incidence [26].

Cleaning and shaping the final form of the entire root canal system are essential steps in the endodontic treatment [27].

Incomplete or inexistent filling of a root canal by omitting its presence is the main causes of endodontic treatment failure [28], thus affecting also the prosthetic restoration.

Location of all root canals will allow clinicians to remove the entire pulp tissue, preventing failures like the incomplete instrumentation or filling of all root canals. For the success of endodontic treatment, it is necessary to detect all the canals, completely clean and then seal them with an inert filling material.

☐ Conclusions

Anatomical variations on the number of roots and root canals can occur on any tooth. The possibility of an additional canal must always be taken into account. The case presented is an exception of the usual root canal anatomy of the second mandibular molar, reminding us that during each endodontic treatment variations are to be expected and that they may alter the course of the endodontic treatment. Molars are frequently used as abutments for various types of prosthetic devices. For the long-term success of any prosthetic rehabilitation, it is very important to know the different morphological variants of root canals to ensure the endodontic treatment's accuracy and also the longevity of restorations.

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