CASE REPORT

Mandibular molar with five root canals

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Abstract
The purpose of this study was to demonstrate the importance of knowledge of the internal anatomy of root canals for the success of endodontic treatment. Lack of knowledge of anatomic variations and their characteristics in different teeth has been pointed out as one of the main causes of endodontic therapy failure. In this report, the authors describe the endodontic treatment of a mandibular first molar with five root canals, evaluate the rate of occurrence of this number of canals, and discuss the importance of their identification and treatment.

Introduction
Knowledge of internal dental anatomy is fundamental to the success of endodontic treatment.

Incomplete instrumentation, inadequate cleaning and shaping, and the subsequent defective obturation of root canals are the main causes of endodontic treatment failure (1). Anatomical characteristics of the different types of teeth and their possible variations are challenges routinely faced by practitioners performing endodontic treatment.

The correct access into the pulp chamber, which should allow access to the orifices of the root canals and an optimal view of the chamber floor, is a fundamental step in endodontic therapy as it enables the identification of any variation in the number and position of root canals (2). Several studies have evaluated the degree of variation in the number of roots and root canals in mandibular first molars.

Hess (3) conducted a study with 512 mandibular first molars and reported that 0.3% of the teeth had only one, 17.7% had two, 78% had three, and 4% had four canals. De Deus (4) studied 75 mandibular molars and found that 8% had two, 56% had three, and 36% had four canals. According to Martinez-Berna and Badanelli (5), several in vitro and in vivo studies have investigated the anatomical configuration and the number of root canals of mandibular molars. The most important studies were those conducted by Hess (3), Okumura (6), Skidmore and Bjorndal (7), Pineda and Kuttler (8), and Hartwell and Bellizzi (9). However, their studies did not report on any case of mandibular molars with five canals.

Fabra-Campos (10) studied 145 mandibular first molars and found that 2.75% of the teeth had five canals. Martinez-Berna and Badanelli (5) conducted a clinical investigation and found 29 teeth with five root canals in a sample of 2362 mandibular permanent molars. Jacobsen et al. (11) found a substantial rate of occurrence of a third mesial canal in mandibular first molars, and reported that 12 out of the 100 molars studied had a third mesial canal.

According to Ingle (12), one of the most important causes of endodontic treatment failure is the incomplete obturation of the root canal system. Therefore, the correct location, instrumentation and obturation of all canals are indispensable procedures. Similarly, Vertucci (13) and De Grood and Cunningham (14) reported that a considerable number of failures could be assigned to anatomical variations, such as the presence of canals not usually found.

This clinical case describes a mandibular first molar with five canals, three distal and two mesial. The third canal of the distal root is called mid-distal or simply third distal canal. The authors review related literature, describe the clinical case and make considerations about how dentists should perform the examination of the pulp chamber to achieve successful results in similar cases.
Case report

A 28-year-old patient presented with a complaint of diffuse pain in the right mandibular first molar. Pulp testing and percussion tests in the region revealed intense and continuous pain and confirmed irreversible acute pulpitis. Radiographs showed deep caries in the tooth and no changes in the apical region. No anatomical abnormality was observed on the radiographs. Endodontic treatment was performed as described below.

First visit

Adequate anaesthesia was obtained and the chamber accessed.

As the negotiation of canals began with a no. 10 file, a third canal was found in the distal root between the previously identified distolingual and distobuccal canals.

After the instrumentation of the cervical third of the root canals, a dental operating microscope (8x magnification) was used to confirm the existence of the five root canals.

The instrumentation of the initial 2/3 of the five visible canals was performed using the hybrid crown-down technique described by Marshall and Papin (15). An apical locator (Endex, Osada, Japan) and a no. 15 file were used to establish working length that was confirmed radiographically.

The second phase of instrumentation, using the hybrid step-back technique, was performed with a no. 30 file for all canals.

Following cleaning, shaping and final irrigation with EDTA for 3 min, the canals were dried with paper points and an intracanal dressing with calcium hydroxide was applied for 14 days (Figs 1–3).

Second visit

In the second visit, the calcium hydroxide intracanal dressing was removed, the master cone fit was checked, and the root canals were dried with absorbing paper points.

Root canals were obturated using the hybrid technique described by Tagger (16). After obturation, glass ionomer cement was used for the temporary sealing (Fig. 4).

Discussion

Studies about the anatomy of root canals conducted by Vande Voorde et al. (17), Badanelli and Martinez-Berna...
(18) and Fabra-Campos (10) reinforced the importance of an accurate clinical evaluation of a possible fourth or fifth root canal to ensure success of endodontic treatment. Martinez-Berna and Badanelli (5) drew attention to the importance of investigating the existence of a fourth and even a fifth root canal.

Several studies investigated the anatomy of root canal systems and the anatomical variations found in the different types of teeth to provide information that might improve the outcome of endodontic treatment. However, few studies discussed the occurrence of a third distal canal in the mandibular first molar. New technologies, such as the dental operating microscope, offer great magnification and illumination of the operating field and substantially improves the visualisation of root canal orifices. Carvalho and Zuolo (19) described the usefulness of microscopes in the accurate location of root canal orifices, which may substantially improve treatment outcomes.

Only Jacobsen et al. (11) found a substantial rate of occurrence of a third mesial canal in mandibular first molars: they reported that 12 out of the 100 molars studied had a third mesial canal.

Clinical evaluations have shown a small but significant number of mandibular molars with five canals (5,20). The region between the distolingual and distobuccal canals should be carefully examined in case of the possible occurrence of a fifth canal.

**Conclusion**

Knowledge of dental anatomy is fundamental for good endodontic practice. Dental operating microscopes are excellent auxiliary clinical resources to locate root canals after good coronal access.

**References**