Abstract
The purpose of this study is 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. Dental operating microscope plays a key role in the identification of canal and success of endodontic treatment. This case series describes the endodontic treatment of mandibular first molars with extra root canals, evaluate the occurrence of this extra canal, and discuss the importance of their identification and treatment.

Keywords: Dental operating microscope; extra canals; mandibular first molar

INTRODUCTION
Knowledge of the internal anatomy of tooth is of prime importance to the success of endodontic treatment. Various causes of endodontic treatment failure are found to be missed canals, incomplete instrumentation, inadequate cleaning and shaping of the root canal system, and subsequently defective obturation of root canal system. Anatomical characteristics of the different types of teeth and their possible variations are challenges routinely faced by practitioners performing endodontic treatment.

Proper access into the pulp chamber, which allows 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.

Several in vitro and in vivo studies have been reported which have investigated the anatomical configuration and the number of root canals of mandibular molars; however, there is limited data in literature reporting cases of mandibular first molars with five canals.

Fabra-Campos observed that 2.75% of the teeth had five canals in his study out of 145 extracted human mandibular first molars. Martinez-Berna and Badanelli in their clinical investigation on 2362 mandibular permanent molars and found 29 teeth with five root canals. Jacobsen et al. reported that 12% of mandibular first molars had three mesial canals.

Vertucci and DeGrood and Cunningham observed that substantial number of treatment failures could be attributed to anatomical variations, such as the presence of extra canals which are not usually found.

Currently, magnification is one of the major components in accurate identification of the canals and therefore the outcome of endodontic treatment. Dental operating microscope, surgical loupes are few of them which help in identifying and locating canals accurately.

This clinical case series describes mandibular first molars with extra canals, three mesial, and two distal canals. The third canal of the mesial root is called mid-mesial canal. This case series is intended to review related literature.
describe the clinical cases, and make considerations about how dentists should perform the examination of the pulp chamber to achieve successful results in similar cases.

CASE REPORTS

Case report 1
A 27-year-old patient reported 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 anesthesia was obtained, tooth was isolated with rubber dam, and the pulp chamber was accessed. As the negotiation of canals began with a no. 10 k-file (Mani, Inc., Japan) third mesial canal was found in between the mesiolingual and mesiobuccal canals along with two distal canals. An apex locator (Root ZX Mini, JMorita, Japan) and a no. 10 k-file were used to establish working length that was confirmed radiographically. The instrumentation of the five visible canals was performed using the hybrid crown-down technique described by Marshall and Papin.[10] Distal canals were enlarged using 6% protaper files (Dentsply India Pvt. Ltd., Bengaluru, Karnataka, India) and all mesial canals were prepared using 4% hyflex files (HyFlex CM, COLTENE ENDO). Ethylenediaminetetraacetic acid (Prime Dental Products Pvt. Ltd., Thane, India), saline (NS, Ahlcon Parenterals [India Ltd.]), and sodium hypochlorite (Prime Dental Products Pvt. Ltd., Thane, India) were used during cleaning and shaping procedure. Following cleaning, shaping, and final irrigation with saline and sodium hypochlorite, the canals were dried with paper points and an intracanal dressing with calcium hydroxide (RC CAL, Prime Dental Products Pvt. Ltd., Thane, India), was given for 7 days.

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 lateral condensation technique. After obturation, calcium sulfate cement (TMP-RS, Prime Dental Products Pvt. Ltd., Thane, India), was used for the temporary sealing [Figure 1].

Case report 2
An 18-year-old patient reported 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.

After adequate anesthesia and rubber dam isolation, the access cavity was prepared. During the exploration of the pulp chamber floor with a dental operating microscope (×12.5 Seiler IQ, St. Louis, Missouri, USA), it was possible to identify five canal orifices: Three in the mesial root and two in the distal root and a perforation on the lingual wall. The perforation was sealed with mineral trioxide aggregate. An apex locator and a no. 10 k-file (Mani, Inc., Japan) were used to establish working length that was confirmed radiographically. The instrumentation of the five visible canals was performed using the hybrid crown-down technique similar to the first case. Root canals were obturated using the lateral condensation technique in the same visit. After obturation, calcium sulfate cement (TMP-RS, Prime Dental Products Pvt. Ltd., Thane, India), was used for the temporary sealing [Figure 2].

Case report 3
A 22-year-old patient reported 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 changes in the apical region. On radiograph, extra distal root was seen (radix entomolaris). Endodontic treatment was performed as described below.

First visit
Adequate anesthesia was obtained, tooth was isolated with rubber dam, and the pulp chamber was accessed. As
the negotiation of canals began with a no. 10 k-file (Mani, Inc., Japan), a third mesial canal was found along with two distal canals. Mid mesial canal that is the third mesial canal was found in the mesial root between the mesiolingual and mesiobuccal canals. An apex locator and a no. 10 k-file were used to establish working length that was confirmed radiographically. The canals were cleaned and shaped in a way similar to the above cases using 6% protaper files with intermittent irrigation with normal saline and sodium hypochlorite solution. Following cleaning, shaping, and final irrigation with saline and sodium hypochlorite (Prime Dental Products Pvt. Ltd., Thane, India), the canals were dried with paper points and an intracanal dressing with calcium hydroxide (RC CAL, Prime Dental Products Pvt. Ltd., Thane, India), was applied for 7 days.

**Second visit**

Same as case report 1 [Figure 3].

**DISCUSSION**

Studies conducted by Vande Voorde et al.,[11] Martinez-Berna and Badanelli.,[12] and Fabra-Campos[5] emphasized the importance of an accurate clinical evaluation of a possible fourth or fifth root canal to ensure the success of endodontic treatment. Martinez-Berna and Badanelli[10] highlighted the importance of investigating the presence 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 mesial 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 improve the visualization of root canal orifices. de Carvalho and Zuolo[13] described the importance of microscopes for accurately locating of root canal orifices, which may substantially improve treatment outcomes.

Clinical evaluations have shown a small but significant number of mandibular molars with five canals.[6,14] The region between the mesiolingual and mesiobuccal canals should be carefully examined in case of the possible occurrence of a mid-mesial canal.

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**Conflicts of interest**

There are no conflicts of interest.

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