CASE REPORT/**CASO CLINICO**

A mandibular molar with four independent mesial roots: a case report

Un molare mandibolare con quattro canali mesiali indipendenti: un case report

KEYWORDS
Endodontic therapy, Mandibular molar, Tooth anatomy

PAROLE CHIAVE
Terapia endodontica, molare mandibolare, anatomia dentaria

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Abstract

Aim: *The most common anatomical configuration of the mandibular molar is to present two roots and three or four canals, but it's possible to find many different configurations. A case of unusual mandibular molar is presented to illustrate the anatomic root canal variation.*
Summary: *Endodontic treatment was performed in a mandibular third molar with five roots, four in the mesial portion and one in the distal portion. The x-ray examination showed an abnormal root canal anatomy, suggesting the presence of extra mesial roots. Cone-beam computed tomography (CBCT) imaging revealed five roots and five root canals, with four independent roots in the mesial portion and one in the distal portion, indicating a rare anatomic configuration. This case report presents the importance of searching for extra canals and the unusual canal morphology, because the knowledge of the most common anatomic characteristics and their possible variations is fundamental to the endodontic treatment success.*
Key learning points: *(A) The major cause of failure in root canal therapy is the inability to localize and treat all of the canals of the root canal system. (B) Mandibular molars may have complex canal systems and variations. (C) The operating microscope and CBCT interpretation are fundamental in confirming and preventing mistakes about the configuration of root canals.*

Obiettivo: *la configurazione anatomica più comune del molare mandibolare è costituita da due radici e tre o quattro canali, ma è possibile trovare molte configurazioni diverse. Viene presentato un raro caso di molare mandibolare per mostrare la variabilità dell'anatomia radicolare.*
Riassunto: *il trattamento endodontico è stato eseguito in un terzo molare mandibolare con quattro radici nella porzione mesiale e una nella porzione distale. L'esame radiografico ha mostrato un'anomalia dell'anatomia radicolare che suggeriva la presenza di altre radici mesiali. Le sezioni della tomografia computerizzata (CBCT) hanno rivelato cinque radici e cinque canali radicolari, con quattro radici indipendenti nella porzione mesiale e una nella parte distale, una rara configurazione anatomica. Questo caso riporta l'importanza della ricerca dei canali accessori e della morfologia inusuale dell'anatomia radicolare, poiché la conoscenza delle più comuni caratteristiche anatomiche e delle loro possibili variabilità è fondamentale per il successo del trattamento endodontico.*
Punti chiave: *(A) La principale causa di fallimento di una terapia canalare è l'incapacità di localizzare e trattare tutti i canali del sistema canalare. (B) I molari inferiori possono avere varianti e sistemi canalari complessi. (C) Il microscopio operativo e la CBCT sono fondamentali per confermare e prevenire errori sulla morfologia dei canali radicolari.*

Introduction

Variation in pulp cavity morphology, especially in multirooted teeth, is a constant challenge for diagnosis and successful endodontic therapy (1). Knowledge of the most common anatomical characteristics and their possible variations is fundamental, because nontreatment of even one canal can lead to endodontic treatment failure.
The main objectives of root canal treatment are thorough cleaning and shaping of all pulp space and its complete obturation with an inert filling material and a coronal filling, preventing ingress of microorganisms (2).

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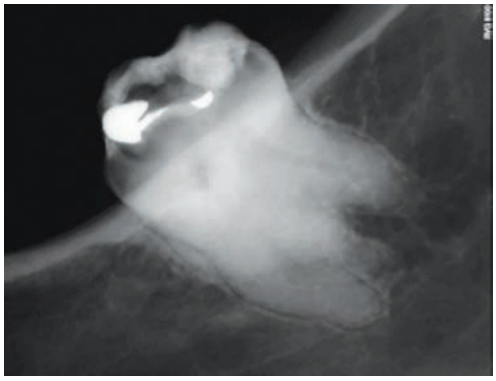


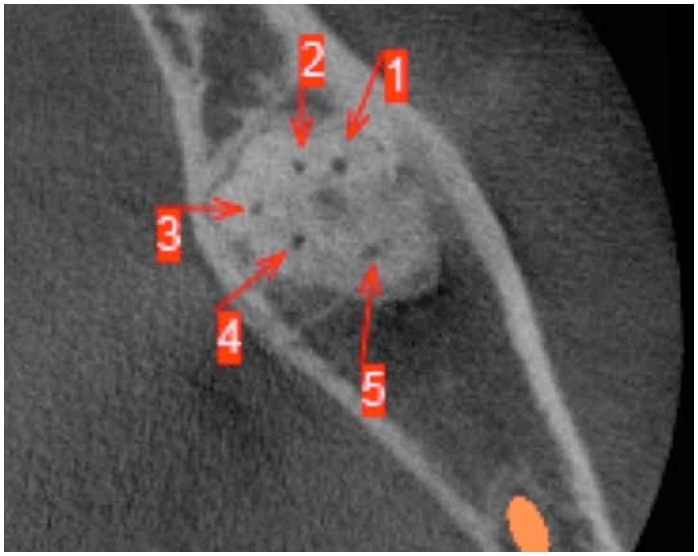
Figure 1
Pretreatment radiograph showingan abnormal root canal anatomy,suggesting the presence of extra mesial roots.

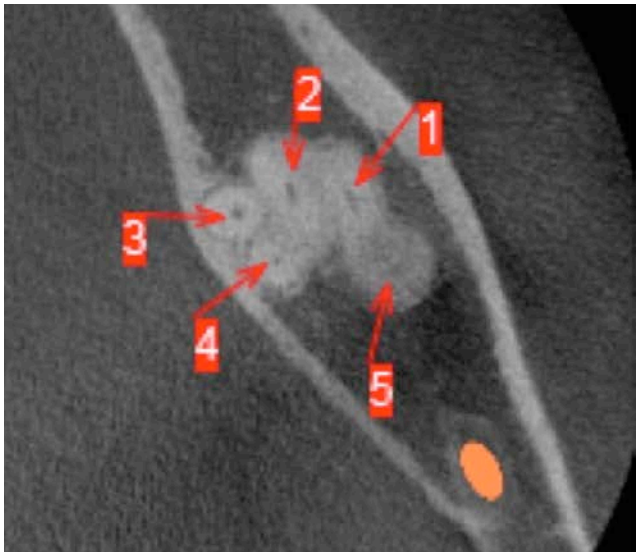
The mandibular first molar usually has two roots, one mesial and one distal, and three or four canals (3, 4). The mesial root has two canals with an isthmus between them (3, 5, 6, 7). This system may have an accessory mesial canal at a prevalence that ranges from 0% to 17% (8, 9). Kottoor (10) and Ahmed (11) found a prevalence rate of 4% and 3% for 3 canals in mesial and distal roots. Therefore, this occurrence in the same tooth is rare (12, 13).
According to Mannocci (14) the morphology of mesial canals in mandibular molars is complex, with a high frequency of intercanal communications. Numerous case reports have described aberrant canals in the mesial root of the mandibular molar (15-18). In the literature, the occurrence of three independent canals in the mesial root has been frequently reported, whether the tooth has one (16), two (17) or three roots (18), but a literature search evidences that the occurrence of four mesial canals in four separate mesial roots has never been described, which indicates a rare anatomical configuration. The purpose of this article was to describe an unusual case of an endodontic treatment of a mandibular molar with five canals in five roots, distributed as four independent mesial roots and one distal root.

Case Report

A 51-year-old female with noncontributory medical history was referred to our dental office complaining of discomfort associated with the left mandible.
Clinical examination revealed the presence of cavity in the left mandibular third molar. The clinical diagnosis was necrotic pulp. History revealed pain on mastication. Neither fistula nor edema was observed in the soft tissue. There was no pain or tenderness on palpation, tooth mobility was within physiological limits, and gingival attachment was normal. The tooth was tender to vertical percussion. Thermal pulp testing (Endo-Frost, Coltène-Whaledent, Langenau, Germany) elicited a negative response.
Pretreatment radiographic evaluation of the tooth showed an abnormal root canal anatomy, suggesting the presence of extra

Figure 2
Computed tomography (CT) scanslices revealing five roots and fiveroot canals.





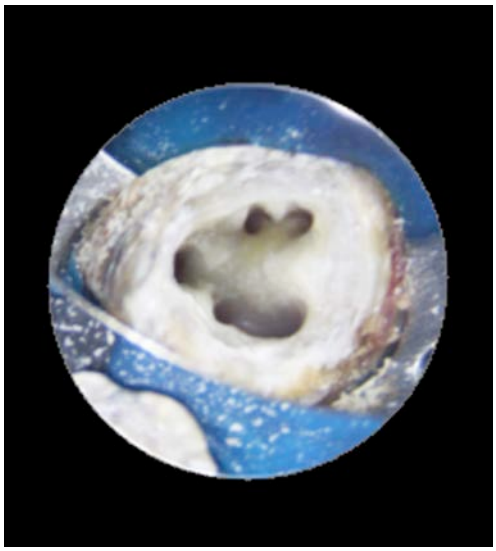


Figure 3
Entry into the pulp chamber evidencing five different canal orifices

mesial roots (figure 1). Cone-beam computed tomography (CBCT) imaging revealed five roots and five root canals, four of which in the mesial portion, and one in the distal portion (figure 2). CBCT images provided valuable information regarding the canal configuration and confirmed the five root canals that were not clearly seen in the conventional radiograph.
The tooth was anesthetized using the standard inferior alveolar nerve blocks with 1.8 ml of 4% articaine with 1:100.000 epinephrine (Articaine, DFL Ind e Com Ltda, Rio de Janeiro, Brazil). After the administration of the local anesthetic, the tooth was isolated, the coronal access was prepared, and the pulp tissue was removed.
During the entry to the pulp chamber, five different canal orifices were revealed, four mesial ones and a distal one (figure 3). The canals were cleansed and the length of each root canal was determined using an electronic apex locator Root ZX (J. Morita, Kyoto, Japan). The root canals were prepared using the Reciproc R25 endodontic file. Sodium hypochlorite (2.5%) and EDTA (17%) solutions were used as irrigants. After cleaning and shaping, the canals were dried and filled using Tagger's technique, with gutta-percha points and root canal sealer (Endofill, Denstply, Petropolis, Rio de Janeiro, Brazil). A final radiograph was taken to establish the quality of the obturation (figure 4).

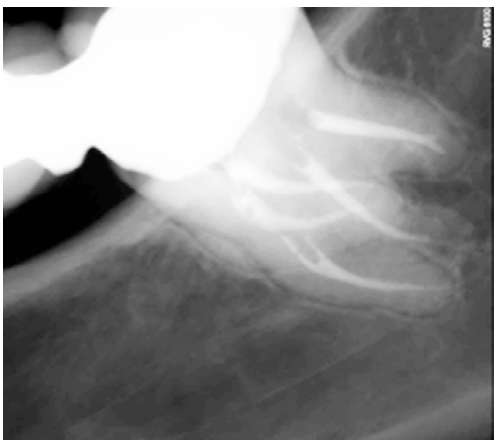


Figure 4
A final radiograph after the completion of the endodontic treatment.

Discussion

The objective of root canal treatment is the thorough mechanical and chemical cleansing of the entire pulp cavity and its complete obturation with an inert filling material and a coronal filling, thus preventing ingress of microorganisms. One of the most important causes of endodontic treatment failure is the incomplete obturation of the root canal system (16). Similarly, Vertucci (4) reported that a considerable number of failures could be assigned to anatomical variations such as the presence of canals that are not usually found. Therefore, the correct location, thorough debridement, cleaning, shaping, and obturation of the entire root canal system are indispensable procedures.
Variation in pulp cavity morphology, especially in multirooted teeth, is a constant challenge for diagnosis and successful endodontic therapy. Knowledge of the most common anatomical characteristics and their possible variations is fundamental, because nontreatment of even one canal can lead to endodontic treatment failure (19).
Teeth anatomy is not always normal, and lack of knowledge of these possible variations in the internal anatomy of human teeth could lead to failure of the endodontic treatment. Case reports are therefore valuable because they remind us that the situation is not always normal and, during each treatment, we must expect many variations (20). The mandibular molar usually has a mesial root with two canals; a

third canal (middle mesial) in the mesial root can be found sporadically; the distal root may have one or two canals, with the presence of a single canal being most prevalent (21).

This case report presents the endodontic treatment of a third molar with abnormal anatomy. Third molars are often extracted but, in some situations, its maintenance becomes important, for being the pillar of a prosthetic restoration, as observed in this case report.

The recent development of technologies for endodontic treatment has focused largely on improving the quality of treatments (22). The introduction of apical locators, nickel-titanium (NiTi) rotary instruments, operating microscopes, digital radiography, and cone-beam computed tomography greatly improved the ability to detect, clean and shape root canals (16, 17, 22, 23).

Plotino (18) presented a case of a mandibular third molar showing four canals in four independent roots, three of which in the mesial portion. The case reported in this article was rare, showing five canals in five roots, four of which in the mesial portion and one in the distal portion, and there are no reports in the literature of such anatomical variation. To accomplish that endodontic treatment, CBCT imaging was essential, making it possible to identify the number of canals and anatomy of the roots, so the use of this exame must be increasingly frequent in endodontics.

Conclusion

This clinical case report describes the endodontic treatment of a mandibular molar with five canals in five roots, distributed as four independent mesial roots and one distal root. Mandibular molars with five root canals and five independent roots are rare, but each case should undergo a careful clinical, radiography and tomography assessment in order to detect any anatomical anomalies. Possible variations in the internal anatomy of human teeth should be known to ensure successful endodontic treatment. Also, accessory canals in mandibular molars should be detected and negotiated to provide access for irrigation and filling materials into otherwise inaccessible isthmus.

Clinical Relevance

This case report shows how a correct interpretation of tomography images and the knowledge of root anatomy and its variations are fundamental to perform a successful endodontic treatment.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgements

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