Case Report

STRANGE ANATOMY OF MAXILLARY FIRST MOLARS: AN ENDODONTIC CHALLENGE: REPORT OF THREE CASES

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ABSTRACT: Background: Knowledge on the root canal system morphology of maxillary molars is an essential prerequisite for the success of root canal therapy. The aim of this article is to present endodontic management of three maxillary first molars with unusual root canal system morphologies. The most common form of maxillary first molar has three roots and four canals, but variations are always present.
Methods: This case report presents one case of single unilateral mesotaurodont maxillary first molar in a healthy person, which is reported for the first time. The second case is a maxillary first molar with two canals in a single root as one of the rarest variations of maxillary first molars, and a maxillary first molar is presented with two roots and two canals. Results: This article extends the range of known possible anatomical variations to include teeth with fewer roots and canals. Conclusion: Clinicians must have proper knowledge on root canal morphology and the possible variations.
Keywords: Anatomic variation, case report, maxillary first molar, root canal treatment.

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INTRODUCTION

The main objectives of root canal therapy are thorough cleaning and shaping of all the canals and their obturation with an inert obturation material; therefore, successful root canal therapy requires a thorough knowledge on the root and root canal morphology and the possible variations. Maxillary first molars have the most complicated roots and canal morphologies of the maxillary dentition.[1,2]

Based on a literature review, the most common form of maxillary first molar has three roots and four root canals.[2] Previous investigations have shown that maxillary first molars might have one to six root canals,[3-7] and cases with C-shaped canal configuration have also been reported.[8]

One of the rarest anatomical variations in these teeth is taurodontism which was first described and reported by Gorjanovic-Kramberger in 1908. In 1913 Sir Arthur Keith proposed the term taurodontism for the "bull-like" configuration of teeth.[9] The characteristic features include an enlarged pulp chamber, apical displacement of the pulpal floor and no anatomical constriction at the level of the cementoenamel junction (CEJ).[10]

The etiology of taurodontism is unclear. The most accepted cause is the failure of Hertwig's epithelial sheath diaphragm to invaginate at the proper horizontal level.[11] Taurodontism has been reported to be associated with several developmental syndromes and anomalies.[11] Based on the severity and furcal displacement, taurodontism has been classified as follows: In hypotaurodontism, considered the mildest aberrant form, only the pulp chamber is enlarged; in mesotaurodontism, regarded as a moderate form, the roots are divided only at the middle third; and in

hypertaurodontism, considered to have the most aberrant anatomical form, the bifurcation or trifurcation is located near the root apices.[10]
This case report presents one case of single unilateral mesotaurodont maxillary first molar in a healthy person, which is reported for the first time. A case of the maxillary first molar is presented with two canals in a single root, considered one of the rarest variations in maxillary first molars. Finally, a maxillary first molar is reported with two roots and two canals. Informed consent was obtained from all the patients to publish this case report.

CASE 1

A 48-year-old healthy female patient, with no history of any systemic diseases, was referred to the Department of Endodontics for the root canal therapy of maxillary right first molar. The patient signed an informed consent form before any pulpal and periapical examinations were carried out. The tooth was sensitive to temperature and electric pulp test but was not tender to percussion. The preoperative radiograph revealed the presence of deep caries. Radiographic examination of this tooth also revealed an unusual anatomy, with an enlarged pulp chamber giving off two short roots with an apically located furcation (Figures 1 and 2A).

Figure 1: Panoramic view

A diagnosis of irreversible pulpitis was established and endodontic treatment was undertaken. Local anesthesia was administered with 2% lidocaine with 1:80000 epinephrine (DarouPakhsh, Tehran, Iran). After access preparation, a single wide orifice was found at the center of pulp cavity floor (Figure 3). An ISO20 K-Flexo file (Dentsply, Maillefer, Switzerland) was used for root canal exploration procedures, followed by the radiographic confirmation of the aberrant root canal system morphology (Figure 2B).
The working lengths were determined by a Root-ZX apex locator (Morita, Tokyo, Japan) and confirmed with a periapical radiograph (Figure 2B).
The canals were instrumented using RaCe rotary instruments (FKG Dentaire, La Chaux-de-Fonds, Switzerland) up to #35/0.04 and irrigated with 2.5% NaOCl. A modified root canal obturation technique was used. The apical portions of the root canals were obturated using lateral condensation technique with gutta-percha and AH26 root canal sealer (Dentsply, De Trey, Konstanz, Germany), while the remaining coronal portions were obturated with warm gutta-percha technique (warm vertical compaction) (Figures 2C and2D). Reinforced ZOE temporary dressing material was used to seal the access cavity. Subsequently, a final restorative material was placed in the access cavity. At 6-month postoperative interval, the patient complained of tenderness of the maxillary left first molar with almost the same anatomy on a conventional radiograph; the tooth had been treated 2 years previously (Figure 4). CBCT images revealed the presence of an extra root canal in the maxillary left first molar, confirming the anatomy of the maxillary first right molar (Figure 5).

Figure 2: (A) Preoperative diagnostic radiograph; (B) Working length determination radiograph; (C) Master guttapercha confirmation; (D) Final radiograph; (E) Six-month recall

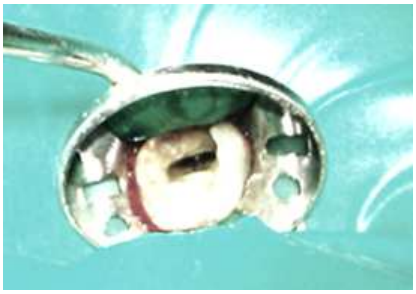

Figure 3: Access preparation photograph

Figure 4: Diagnostic radiograph of maxillary left first molar

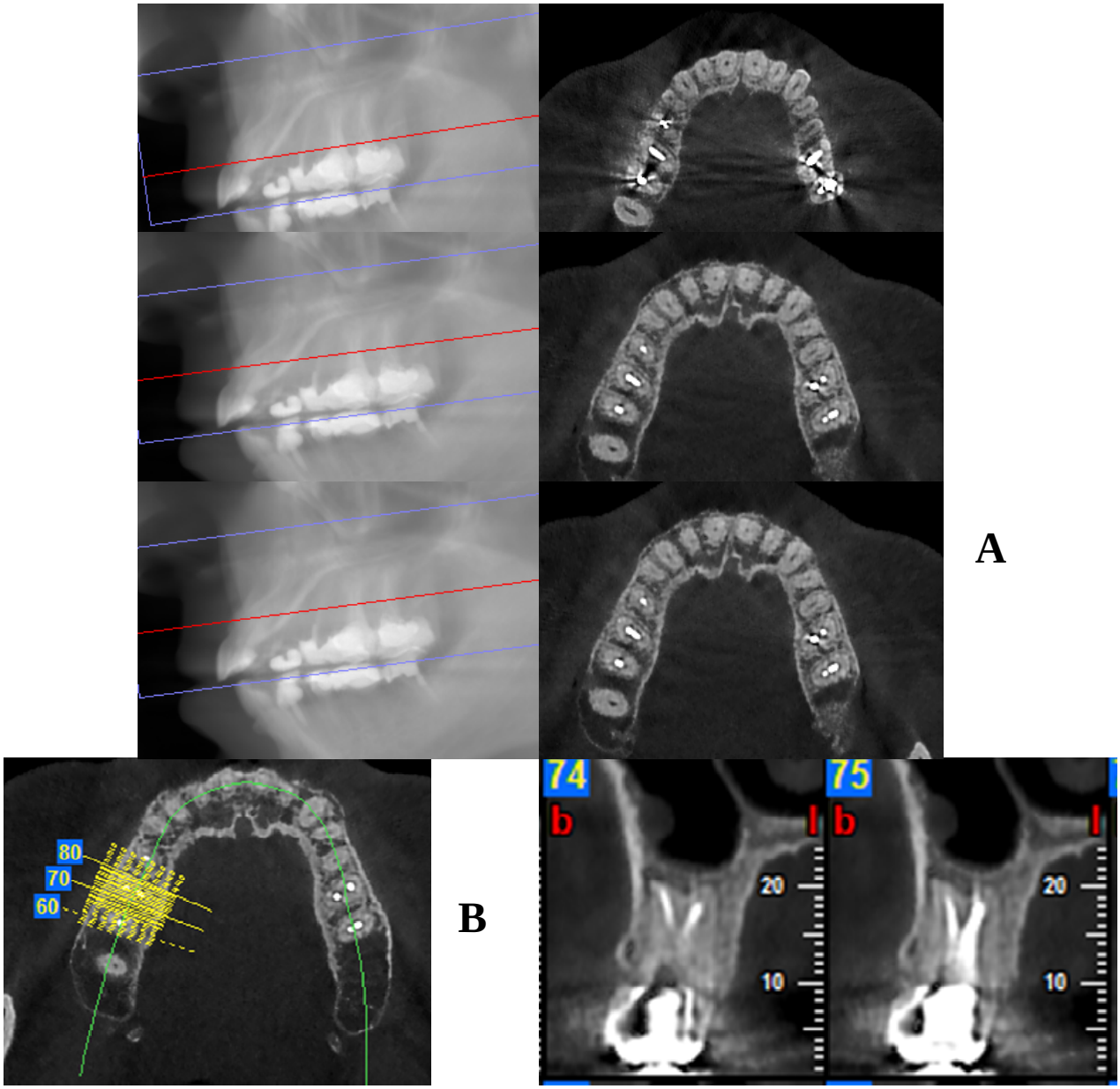

Figure 5: CBCT images of maxillary dental arc showing: (A) saggital sections and (B) axial sections

CASE 2

The female patient, 18years of age, had no history of any systemic diseases and complained of spontaneous pain in her left maxillary first molar. Pulpal and periapical examinations were carried out after informed consent was obtained. The pulp did not mount any responses to vitality tests, but the tooth was sensitive to percussion. Radiographic evaluation revealed a deep composite resin restoration at pulp proximity. In addition, there was a single conical root with a periapical radiolucent lesion on the radiograph (Figure 6A).

A diagnosis of a non-vital left maxillary first molar was established, in association with acute apical periodontitis; therefore, endodontic treatment was undertaken.

Local anesthesia was administered, followed by access cavity preparation and isolation of the tooth with a rubber dam. One root canal orifice with two canals was identified. The root canals were explored with an ISO20K-Flexofile (Dentsply). The working lengths were determined (Figure 6C) and the root canals were prepared and obturated as described for case 1.

CASE 3

A 32-year-old female patient was referred to the Department of Endodontics for endodontic treatment of maxillary left first molar. Pulpal and periapical examinations were carried out after informed consent was obtained. The tooth was sensitive to temperature and electric pulp test, with no tenderness to percussion. Radiographic examination revealed a deep carious lesion on the mesial aspect of the tooth (Figure 7A), which was removed, followed by access cavity preparation. Two root canal orifices were located in the buccal and palatal aspects of the access cavity. Compared to typical buccal orifice diameters, the buccal orifice was larger. The root canals were explored using anISO20K-Flexofile (Dentsply) and two root canals were identified, confirmed by radiographic examination (Figure 7B). The working lengths were determined (Figure 3C) and the canals were prepared and obturated with gutta-percha and AH26 sealer, using lateral condensation technique as described for case 1 (Figures 7C and 7D).

A B C

Figure 6: Radiographs of maxillary first molar; (A) preoperative radiograph; (B) working length determination; (C) final image.

A B C D E

Figure7: (A) Preoperative diagnostic radiograph; (B) Working length determination radiograph; (C) Master guttapercha confirmation; (D)Final radiograph; (E)Six-month recall

DISCUSSION

Proper knowledge on the root canal system morphology is absolutely necessary for successful root canal treatment.[1] Generally, maxillary first molars have three roots and three or four root canals,[2] but there are variations, too.[3-8] Some of the most common iatrogenic access opening errors ,such as perforations and excessive removal of tooth structures, occur during the search for missing or extra canals. This case report presented three of the rarest variations in maxillary first molars, which might lead to iatrogenic errors during the search for missing or extra canals. The prudent dental practitioner should perform an accurate radiographic evaluation of teeth before treatment. Furthermore, root canal morphology should be evaluated during treatment sessions on radiographs taken from different horizontal angles. Preoperative radiographs and additional radiographic views with 20° mesial or distal angulations might prove useful in assessing the root canal morphology and CBCT images might be useful in complicated cases.[8]

Krasner and Rankow designed a proper technique to evaluate the relationship of the pulp chamber with the clinical crown and pulp chamber floor.[13] Their guidelines are considered useful diagnostic aids for identifying missed and elusive root canals.

In case 1 we represented a maxillary first molar with mesotaurodont morphology, similar to a case reported by Shaktidar,[14] but this case is single and unilateral, and it is for the first time that unilateral maxillary first molar with such an anatomy is reported. Sert[12] also reported this morphology (an extreme case of taurodontism with the furcation near the apices of the roots) in both mandibular second molars and the maxillary first and second molars.

Taurodontism is frequently associated with various syndromes and is most commonly seen in mandibular molars.[14] In this case the patient was not known to be suffering from any disease or syndrome.

Endodontic treatment of a taurodont tooth is a challenge for the endodontist. The apical placement of the pulpal floor should be kept in mind during access cavity preparation to prevent perforation. There is great variability regarding the number of canals in a taurodont tooth; therefore, the clinician should search properly for the presence of extra canals.

Widerman and Setene recommended the use of 2.5% NaOCl for dissolving the remaining pulp tissues.[15] The variation in the pulpal anatomy with short roots and large pulp chambers necessitates a modified obturation technique, i.e. lateral compaction apically, followed by warm vertical compaction.[9]

In case 2 we represented a single-rooted maxillary first molar with 2 canals, which is one of the rarest morphologic variations.

Finally, in case 3 we represented a two-rooted maxillary first molar with two canals. This type of morphology has rarely been reported, with 0.4% of the first maxillary molars and 2.2% of the second maxillary molars having been reported to have such an aberrant morphology.[3]

CONCLUSION

Clinicians must have proper knowledge on root canal morphology and the possible variations. The dental practitioner should perform an accurate radiographic evaluation of teeth before and during root canal treatment; in this context, CBCT images might be useful in complex cases.

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