

An Unusual Maxillary Molar with Four Roots and Four Buccal Canals Confirmed with the Aid of Spiral Computed Tomography: A Case Report

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Abstract:

This case report describes an endodontically managed maxillary first molar with an unusual morphology of five canals. Maxillary first molar has one of the most complex root and canal anatomy. The greatest variations observed are the presence of two canals in the mesiobuccal root of maxillary molar, canals in the furcation area and the presence of lateral and accessory canals. The incidence of two distobuccal canals in itself is quite rare. A literature search revealed only a few case reports of four buccal canals in maxillary first molars. This case report presents the successful root canal treatment of the maxillary first molar with four roots and five canals. The use of spiral computed tomography scan in this case greatly contributed towards confirming this rare morphology.

Key Words: Canal, four buccal canals, maxillary first molar, morphology, spiral computed tomography

Introduction

Maxillary first molar is one of the most treated and the least understood tooth in the dental arch. Smadi and Khraisat¹ had reported that the maxillary first molar has a high failure rate of orthograde root canal treatment. The failure is often due to the presence of extra canals that the clinician fails to detect, debride and obturate.

The incidence of second mesiobuccal canals in the mesiobuccal root of maxillary first molars has been reported in the range between 33% and 96% *ex-vivo* and 17-65% *in vivo*.²⁻⁵ The incidence of two canals in the distobuccal (DB) rootis, however, unusual. Sert and Bayirli reported that the incidence of two or more canals in the DB root of maxillary first molars was 9.50% *ex vivo*⁶ Alavi *et al.* have reported that the incidence of two canals

in DB roots was 1.90%.⁷ Kottoor *et al.* have also reported extra canals not only in the distal root, but all three roots.⁸

The conventional intra-oral periapical radiographs are not completely reliable owing to their inherent limitations. Diagnostic tools like the spiral computed tomography (spiral CT) has overcome the disadvantages of radiographs by producing a three-dimensional (3D) image.⁹ This case report presents a successful root canal treatment in a maxillary first molar with four roots and five canals, which were confirmed with spiral CT.

Case Report

A 31-year-old female (Indian) was referred to the Department of Conservative Dentistry, School of Dental Sciences, Sharda University, with a chief complaint of spontaneous severe pain with tooth no 3 (International Dental Federation). On examination, the tooth had deep occlusal caries. Heated gutta-percha test gave response of intense lingering pain. Tooth was non-tender on percussion and had no periodontal pockets or mobility. The medical history was non-contributory. A diagnosis of symptomatic irreversible pulpitis with normal periapical tissues was established. The tooth was anesthetized and isolated with rubber dam and an endodontic access was established. Outline of the access cavity was modified to a rhomboidal shape to improve the visibility of extra canals. After locating the main three canals, the floor was dried, visualized and then using a sharp endodontic explorer the grooves were explored. On the mesiobuccal side, the second mesiobuccal canal was located with the exploration. On the DB side, a troughing procedure was performed with an ultrasonic tip (ETBD, Satelec Acteon, UK). The groove running palatally from the major DB to palatal was widened 0.5-1 mm for a length of 2-3 mm at the expense of the distal wall. Throughout the procedure, intermittent irrigation with sodium hypochlorite 3% (Novo Dental Products, India) was carried out and at all times care was taken not to perforate or weaken the walls. Five distinct canal orifices were defined as follows: two in the DB and two in the mesiobuccal and one palatal. Once the orifices were located the second mesiobuccal and the second DB canals were negotiated using size 06, 08, 10 K-files. The working lengths were determined with an electronic apex locator (Root ZX, J Morita Corp, Kyoto, Japan) and confirmed radiographically (Figure 1).

Root canal instrumentation was performed using ProTaper nickel titanium rotary instruments and hand instruments in a

crown-down manner. Irrigation between each instrument was done using 3% sodium hypochlorite solution. Final irrigation was done with 17% ethylene diamino tetra acetic acid solution and dried with paper points. Radiograph with the master cones were taken. Obturation was done with AH Plus (Dentsply De Trey GmbH, Konstanz, Germany) and laterally condensed gutta-percha (Dentstply Maillefer, Ballaigues, Switzerland) (Figure 2).

A final post-obturation radiograph obtained (Figure 3).

The tooth was subsequently restored. Patient reported after 3 months with now a chief complaint of spontaneous lingering pain in the second maxillary molar. Tooth no 2 had mesioocclusal caries, responded with lingering dull ache to heated gutta-percha. No periodontal pockets or mobility was recorded. Again a diagnosis of symptomatic irreversible pulpitis with normal periapical tissues was made. Prior to starting the root canal treatment, to confirm the root and canal morphology of the second molar and to ascertain the completeness of the filling spiral CT was taken instead of a conventional radiograph. Informed consent of the patient was obtained. A multislice helical or spiral CT imaging was performed in the maxilla using dental software: Dentascan (GE healthcare, USA). A 3D image of the maxilla was obtained. The maxillary right first molar was focused and its morphology was obtained in both longitudinal and cross sections of 0.5 mm in thickness. The spiral CT images of tooth no 3 showed that there were two mesiobuccal roots and only one DB root (Figures 4a-e and 5).

As shown in Figure 4b, the two mesiobuccal canals exited through two separate apical foramen. It was interesting to note that the two DB canals fused at the coronal third itself into one canal (Figure 6).

This observation was different from what appeared in the working length and post-obturation radiograph. Thus, the canal morphology in the DB can now be classified as Vertucci's Type II Configuration.¹⁰ The palatal root though appeared straight on the radiograph showed a slight buccal curvature in the apical third. The contra lateral first molar showed another interesting observation. Not only was the canal configuration slightly different from the right side, inter-connecting isthmuses were clearly seen from the apical view (Figure 7).

Discussion

The maxillary first molar root anatomy is pre-dominantly a three rooted form, as shown by several anatomical studies.^{9,10} The four-rooted anatomy in its various forms is very rare in the maxillary first molar and is more likely to occur in the second or the third maxillary molar.¹¹ The 3D spiral CT image in our study clearly showed the presence of four roots in this case.

The important studies that documented the presence of extra canals and unusual morphology in maxillary molar have been summarized in Table 1.

Table 1 clearly shows that the DB canals with Type II vertucci's morphology are extremely rare. Only two case reports so far have shown the presence of two DB canals that join in the

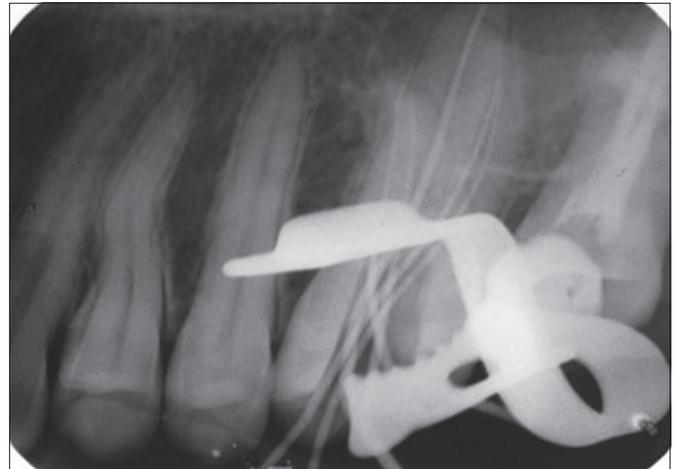


Figure 1: Working length radiograph.

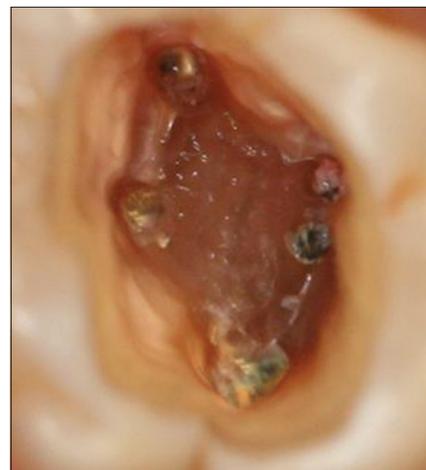


Figure 2: Canals after obturation.

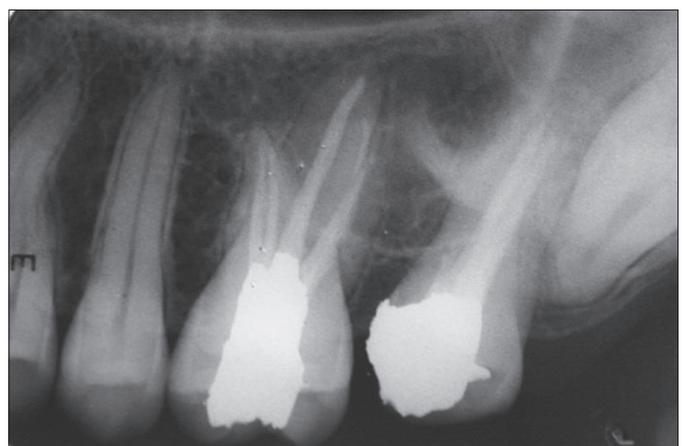


Figure 3: post-obturation radiograph.

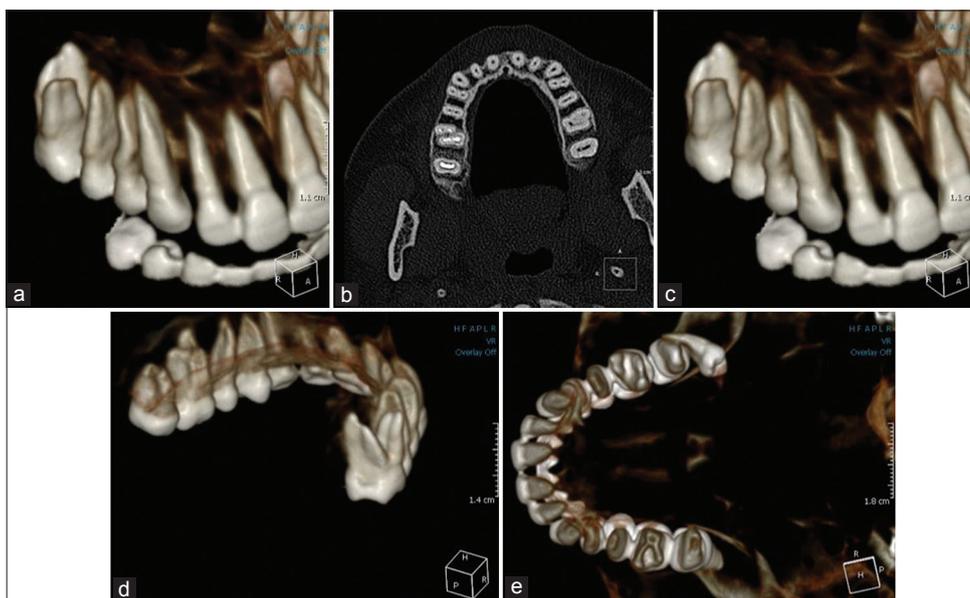


Figure 4a-e: Spiral computed tomography images showing two mesiobuccal roots and one distobuccal root.



Figure 5: Spiral computed tomography image showing two mesio buccal roots and one distobuccal root, and a palatal root.

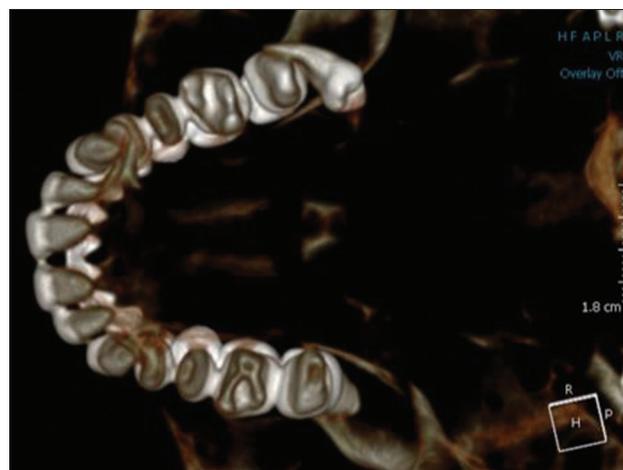


Figure 7: The contra lateral first molar showing interconnecting isthmuses clearly seen from the apical view.



Figure 6: Two distobuccal canals fused at the coronal third itself into one canal.

apical third.^{12,13} The present case shows the joining of the DB canals in the coronal third itself, which was clearly confirmed with the aid of spiral CT.

Vertucci found the proximity of the canal orifices to each other as indicative of whether they joined or remained as separate canals. If the separation of orifices was >3 mm, the canals tended to remain separate through the entire length. In contrast, canals usually joined together if the orifices were <3 mm apart. Canals were found to join more coronally as the distance between the orifices decreased. This finding correlated with our observation in the present case where the two DB canals fused in the coronal third itself. The fact that observation was not evident clinically and radiographically, but was evident with a spiral CT, emphasizes the vital role of this diagnostic tool in preventing endodontic failures.

Table 1: Case reports of maxillary first molar unusual morphology.

Arturo Martinez-Berna (1983) (2 cases) ¹⁴	6 canals with 3 mesiobuccal, 2 distobuccal and 1 palatal
Lior Holtzman (1997) (2 cases) ¹⁵	5 canals with 2 mesiobuccal, 1 distobuccal and 2 palatal
Michael Hulsmann (1997) ¹⁶	4 canals with 2 distobuccal, 1 mesiobuccal and 1 palatal
Peter M. Di Fiore (1999) ¹⁷	4 roots - distobuccal, distopalatal, mesiobuccal and mesiopalatal
L. R. G. Fava (2001) ¹⁸	2 roots - buccal and palatal, with Weine's type IV configuration in the buccal root
R. J. G. De Moor (2002) (4 cases) ¹⁹	C-shaped canal configuration
F. Baratto-Filho et al. (2002) ²⁰	2 palatal roots, each with separate canal i.e., 2 palatal canals and 1 mesiobuccal and distobuccal canal
F. Maggiore, Y. T. Jou & S. Kim (2002) ²¹	6 canals with 2 mesiobuccal, 3 palatal and 1 distobuccal
Barbizam JV, Ribeiro RG, Filho MT (2004) (2 cases) ²²	4 roots and an extracted molar with 5 roots
Ferguson DB, Kjar KS, Hartwell GR. (2005) (1 case) ²³	Three canals in the mesiobuccal root
N Adanir (2007) (1 case) ²⁴	Four roots and six canals. Mesiobuccal and mesiopalatal, distobuccal and distopalatal and palatal
Poorni S, Kumar A, Indira R. (2008) (3 cases) ²⁵	2 canals in the palatal root showing Vertucci's Type II configuration
Cobankara FK, Terlemez A, Orucoglu H. (2008) (1 case) ²⁶	Single root and single canal
Aggarwal V, Singla M, Logani A, Shah N (2009) (1 case) ²⁷	Two palatal canals separate orifices and separate foramen
de Almeida-Gomes F, Maniglia-Ferreira C, Carvalho de Sousa B, Alves dos Santos R (2009) (1 case) ²⁸	Six root canals
Kottoor J, Velmurugan N, Sudha R, Hemamalathi S. (2010) (1 case) ⁸	Seven root canals
Kottor et al (2010) (1 case) ²⁹	Eight root canals

Spiral CT also gives a clear advantage over the conventional diagnostic tools in that it can be simultaneously used to diagnose the other teeth morphology suspected of having extra canals. This case confirms the necessity of meticulous examination of the floor of the pulp chamber in conjunction with recent imaging technologies for detection of extra canals.

Conclusion

Treating the extra canals in maxillary first molars may be challenging for the clinicians. Inability to find and properly treat the root canals may cause failures. The use of ultrasonics and spiral CT in the above case show that endodontic research and technology are continually evolving to enable the practitioners to identify, disinfect, and obturate root canal systems predictably and efficiently.

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