Introduction

Besides adequate knowledge of root canal morphology in general, it is of utmost importance to evaluate each individual case for aberrant anatomy and to identify any morphological variation before performing and during an endodontic procedure on such teeth. In clinical practice, conventional radiography with the assistance of an operating microscope is the most common method for evaluating root canal anatomy. However, it has been shown that their use does not reveal all anatomical details. Recently introduced and developed cone beam computed tomography (CBCT) for dental use has proved to be more accurate in detecting root canal morphology, especially in maxillary posterior teeth. One of the most unusual and rare aberrations of tooth anatomy is a maxillary second molar with two separated palatal roots. This article presents the case of such a patient, who presented ten years after another such patient had been recorded.

Case report

A 26-year-old male patient sought treatment at the Department of Restorative Odontology and Endodontics at the University of Belgrade with the following chief symptoms, which had persisted for several weeks already:

- spontaneous dull, mild and intermittent pain in the region of the left maxillary molar;
- moderate sensation of pain when biting hard food.

Additional information was acquired from further anamnesis:

- There were no other symptoms, and no irradiation of existing pain.
- The patient recalled that a root canal therapy had been performed on the same tooth several years before.
- He also recalled that two teeth on the same side of the upper jaw had been extracted at least ten years before.

Furthermore, clinical examination confirmed the following:

- only the second molar, #27, with an extensive amalgam restoration, was present in the left maxilla;
- moderate sensitivity on vertical percussion of the buccal cusps, and painful response to percussion of the mesiopalatal cusp;
- no sensitivity on digital palpation on the vestibular or palatal side;
- both hot–cold and electric vitality tests were negative;
- no pathological mobility of the tooth.

The diagnostic periapical radiograph (bisecting angle technique) showed...
Case Report

CBCT in Diagnosis

Partly obturated palatal and mesiobuccal (MB) root canals and an unfilled distobuccal (DB) root canal; slight radiolucency around the palatal root apex; no distinctive border towards the surrounding maxillary bone structure.

The necessity of an endodontic retreatment of the tooth was explained in detail to the patient, who accepted the suggested therapeutic procedure and the general schedule for further appointments.

Treatment Procedure

The old amalgam restoration and the phosphate cement base were completely removed, and the cavity walls were additionally prepared to enable clear visibility and straight-line access to all root canal orifices. The orifices of the palatal and MB root canals had been blocked with obturation material, presumably iodine phosphate cement and a gutta-percha cone. Approximately 3 mm distal from the orifice of the obturated palatal root canal, another oval, crack-like orifice could be seen, with the appearance of a perforation. Further assessment of the pulp chamber floor was performed with 4.5 x magnifying loupes and the Endodontic Probe Orifice Opener (DENTSPLY Maillefer). Using the probe and a #10 K-file to negotiate the flat oval orifice, the presence of a second palatal (distopalatal, DP) root canal was detected.

The orifice of the DB root canal was hidden under brownish deposits of tertiary dentine, located about 2 mm distal from the obturated MB canal orifice and approximately 2 mm buccal from the DP canal orifice. The DB canal orifice was negotiated and slightly widened with the Orifice Opener, ensuring that it could be easily detected in a further procedure. The second MB root canal could not be found with meticulous searching under loupes and the application of a decalcifying solution (17 % EDTA).

After consultation and receiving the approval of the patient, it was decided to conduct the entire procedure in at least two sessions. First, the root filling material in the MB and mesiobuccal (MP) root canals was removed using rotating NiTi files, ProTaper D1, D2 and D3 files (DENTSPLY Maillefer), and manual H-files (DENTSPLY Maillefer). Further instrumentation of those canals was performed using WaveOne files (DENTSPLY Maillefer) with reciprocating motion: the MP canal with black (#40) and the MB canal with red (#25). The working length was determined and checked throughout the entire procedure using an electronic apex locator (RomiApex A-15, Romidan).

The DP root canal was then negotiated and a glide path was created approximately 1–1.5 mm shy of the apical foramen using #10 and 15 K-files. The coronal portion was flared successively with #3 and 2 Gates-Glidden drills. The same procedure was performed at the DB root canal. Clear visibility and straight-line access were established for all four canals (Fig. 1).

Two intra-oral radiographs were captured from two different horizontal angles with an inserted K-file in each root canal, but only one revealed all four root canals (Fig. 2), showing vague contours of the apical portion of the roots.

A calcium hydroxide dressing was applied at the MP root canal and a paper point, soaked with a 2 % solution of chlorhexidine (R4, Septodont), was left in the MB root canal. A cotton pellet with chlorhexidine dressing was placed (Fig. 3). Two intra-oral radiographs were taken to confirm the root filling (Fig. 4).

Figs. 5–7. Axial view of the middle level, axial view of the apical level, and sagittal detailed view of tooth #27.
was left in the pulp chamber and the cavity was then sealed with a temporary filling material.

In the second session, two weeks later, the DP and DB root canals were carefully prepared, applying the same WaveOne technique as used for the MP and MB root canals: the DP canal with WaveOne black (#40) and the DB canal with WaveOne red (#25). The working length was determined and checked using the same electronic apex locator.

Throughout the entire endodontic procedure, 2.2% sodium hypochlorite and 10% citric acid solutions were used as irrigants, successively, in all four root canals. Each of the four canals was finally irrigated with 40 ml of a 2.2% NaOCl solution, dried and obturated using Acroseal (Septodont) and a single gutta-percha cone with an adequate taper (DENTSPLY Maillefer; Fig. 3).

The intra-oral, retro-alveolar radiograph captured post-treatment was of relatively poor quality owing to superimposition and interference of the infrazygomatic arch and adjacent bone structures, and failed to show the most important apical portions of the roots with the correct root canal fillings (Fig. 4).

In agreement with the patient, a CBCT scan was obtained, primarily to check the treatment outcome, but also to document this extremely rare case with much more accurate and reliable images. The small field of view (50 x 50 mm) was recommended, and the data was acquired by SCANORA 3Dx (SOREDEX) immediately after the treatment and at the six-month recall.

The edited images (OnDemand3D, Cybermed) clearly visualized two distinctive palatal roots, their relation to the two buccal roots, the adjacent anatomic structures and, most importantly, the quality of the obturation of all four root canals (Figs. 5–9, arrows).

**Conclusion and key learning points**

A careful assessment of the internal anatomy of the pulp chamber is essential for detecting all root canals.

A maxillary second molar with two separate palatal roots is a rare anatomic variation and, according to our records, is detected only once in a decade.

CBCT images provide more accurate and reliable information regarding roots and the root canal morphology than conventional radiographs are able to provide. Furthermore, concerning the treatment outcome, CBCT images enable a much more predictable and successful endodontic treatment procedure.

**Editorial note:** This article is based on the work presented at the 16th congress of the European Society of Endodontology in Lisbon in Portugal in 2013.

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