



The Use of Dentascan to Diagnose and Treat Mandibular Premolar with Multiple Canals

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Authors' contributions

This work was carried out in collaboration between all authors. All authors have directly participated in the treatment planning, literature search, writing and proof reading of the manuscript analysis of this case report.

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Case Report

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ABSTRACT

Introduction: For successful endodontic therapy it is vital to have thorough knowledge of morphology of the root canal system and its variations besides proficient aseptic intraoperative condition. Mandibular second premolars are usually single rooted tooth with single root canal system. The incidence of the number of roots and the number of canals varies greatly in the literature.

Methods and Results: This case report describes an unusual case of mandibular second premolar with two roots and five root canals. This was confirmed by radiographs, dentascan and dental operating microscope (DOM), and was successfully treated using K files system, gutta-percha and AH plus sealer in lateral condensation manner.

Conclusion: The clinical significance of this case report is that the precise awareness about the

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aberrant morphologies of the root canal system can only be appreciated when advanced radiographic techniques, magnification and illumination are used to treat such type of cases.

Keywords: Mandibular premolar; root canal morphology; endodontic therapy dentascan; dental operating microscope (DOM).

1. INTRODUCTION

The incomplete canal instrumentation and its defective obturation is one of the key for endodontic failure. A scrupulous awareness regarding the root canal morphology and its anatomical variation is indispensable for negotiation, cleaning and shaping and 3-dimensional obturation of the entire root canal system to prevent failure of the nonsurgical root canal therapy (NSRCT). Various anatomic studies have reported a highly complex and variable morphology of mandibular second premolar due to several factors like age, gender, ethnicity, unintentional bias in case selection (endodontic practice versus general dental practice) and study design (in vitro versus in vivo) [1]. The mandibular premolars are therefore the most difficult teeth to treat endodontically.

Mandibular second premolars are mostly single rooted tooth with single root canal system in approximately 65.7 to 100% cases [2]. Most authors reported the cases having two roots canals ranging from 1.2 to 11.7% [3]. Mandibular second premolars with four and five root canals were presented by Al-Fouzan and Macri & Zmener respectively [4,5]. These studies demonstrate that such variations might occur in routine dental practices, in spite of their low incidence.

Although morphological variations of the root canal system have been well documented and diagnosed by cone beam computed tomography and optical microscopy, the literature has documentation mostly from studies with two dimensional radiographs used as tools for confirmation of the reports [1]. However radiographs are of limited value in determining aberrant anatomies due to inherent limitations. The use of spiral computed tomography (SCT) for imaging and three dimensional reconstructions through Dentascan gives a complete insight into root canal configuration of the tooth [6]. Therefore, we are presenting here a unique case of endodontic management of mandibular second premolar with two roots and five separate canals using periapical radiographs, Dentascan and dental operating microscope.

2. CASE PRESENTATION

A 25 year old male patient reported to the department of conservative dentistry and endodontics with chief complaint of severe pain in lower left back region for seven days. Patient's medical history was non-contributory. On clinical examination, mandibular left second premolar was found to be grossly decayed with tender on percussion. Pain was spontaneous and get aggravated on chewing and lying down. No intraoral swelling, fistula and periodontal pocket were observed. Pulp vitality testing using tetrafluoroethane (Endo-Ice, Hygenic Corp., Akron, OH) caused severe lingering pain. The preoperative horizontally angled periapical radiographs were taken. Radiographic examination of the involved tooth revealed the presence of two separate roots with multiple canals with the periapical radiolucency (Fig. 1a). Dentascan (Siemens Germany) was done after taking consent for confirmation of extra canals (Fig. 1b). Based on clinical and radiographic findings, a provisional diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made.

Treatment options including non-surgical root canal therapy, extraction and implant were presented and explained to the patient. The patient decided to have non-surgical root canal therapy. Informed consent was obtained. Local anesthesia was administered using 2% lidocaine with 1:200000 adrenaline. Under Rubber dam, all decayed tissues were excavated and five different canals were located with the help of dental operating surgical microscope (Zeiss) and DG -16 endodontic explorer (Hu-Friedy, USA), two in the mesial root and three in the distal root (Fig. 1e). All the canals were negotiated with # 10 K file file and a working length radiograph was taken (Fig. 1c). All the canals were instrumented up to #25 K files in a crown down fashion and copiously irrigated with 5.25% sodium hypochlorite and normal saline. After that, canals were irrigated with 17% EDTA for complete smear layer removal. The canals were finally rinsed with deionized water obtained by using the Milli-Q water purification system to remove possible dentinal chips and dried with

absorbent paper points. Access cavity was sealed with intermediate restorative material (IRM).

The patient was recalled after 3 days and he was found asymptomatic. The temporary restoration was removed. The canals were irrigated copiously with normal saline. The master apical file was selected as #25 and the master cones periapical radiograph was taken to verify the apical fit. The canal were dried with absorbent paper points and obturated with gutta-percha and resin based root canal sealer (AH Plus) using lateral condensation technique. The access cavity was closed with glass ionomer cement. A final radiograph was taken (Fig. 1d). Patient was found asymptomatic at 3 months follow up.

3. DISCUSSION

The main objective of root canal treatment is meticulous cleaning and shaping to eliminate bacteria and complete filling of the canals with a biocompatible filling materials. Hess reported that the roots having a tapered canal and a single

foramen were the exception rather than rule [7]. According to Cohen et al. [8] root canals are often not treated because they are not located. The clinician should always give special attention to find out any evidence of the occurrence of anatomical variations throughout the entire procedure.

Variations and complexities in root canal morphology of mandibular premolars often present challenges in carrying out successful root canal treatment. The primary step in treating such teeth is therefore the precise evaluation of high quality preoperative radiograph taken at different horizontal angulations to identify root canal morphology and to locate extra canals [9]. The root shape, root position, and its relative outline should carefully be determined from the radiographs. In the present case, with the help of conventional radiograph we were easily able to ascertain the presence of two roots and extra canals in the involved tooth. So there should be a constant vigilance in locating 2 or more canal systems in the mandibular second premolar.

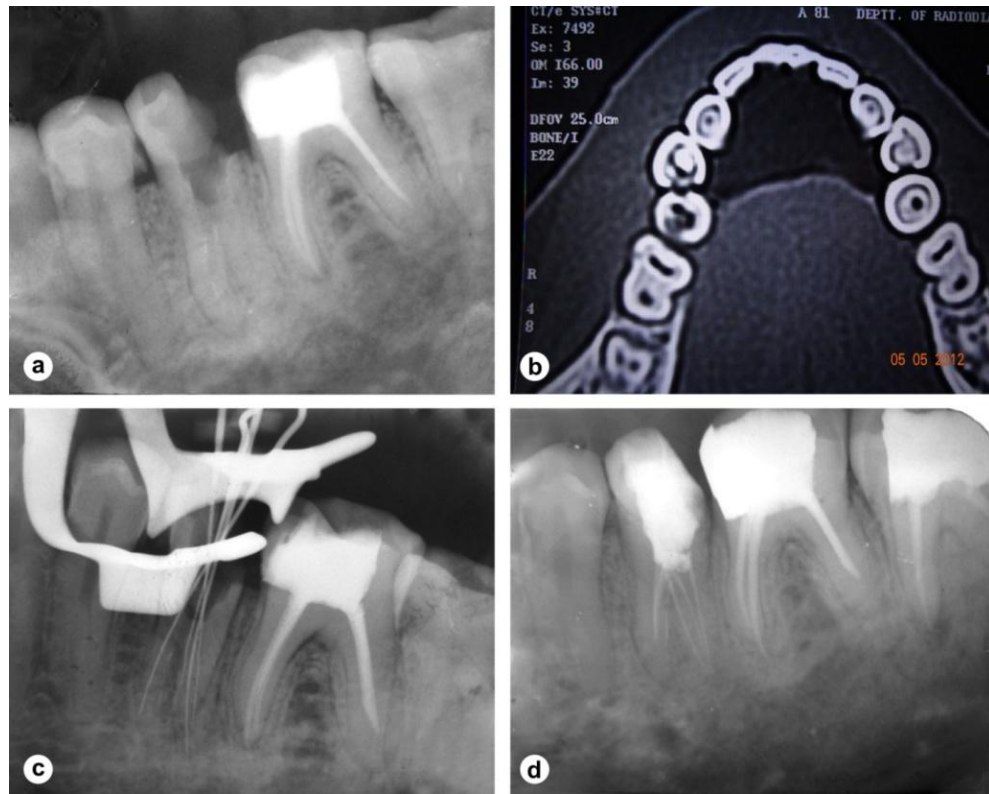


Fig. 1a. Preoperative radiograph, Fig. 1b. Preoperative dentascans, Fig. 1c. Working length radiograph, Fig. 1d. Post operative radiograph

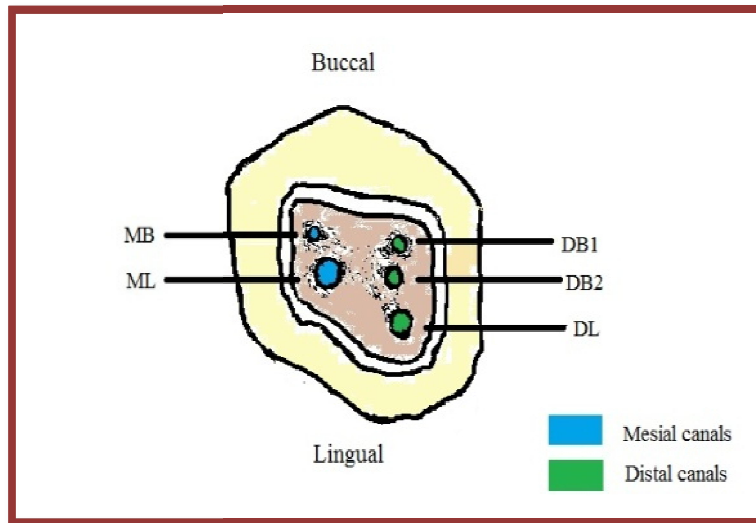


Fig. 1e. Schematic representation of distribution and location of five root canal orifices in mandibular second premolar (left side)

Several clinical indications may be useful in detection of extra canals in mandibular second premolars. Sudden narrowing or disappearing pulp space may indicate the presence of additional canals. Gulabivala et al. [10] concluded that broad, flat roots are more likely to contain multiple canals and ramifications. If the radiograph shows deviation of pulp chamber from normal configuration and overly large pulp chamber in mesiodistal direction, more than one canal should be suspected. In the present case, during exploration of the canals, the presence of the bleeding points on the pulp chamber floor was indicative of more canals and aided in the location of extra canals. Champagne bubble test can also be performed to negotiate extra canal orifices by allowing sodium hypochlorite solution in pulp chamber [8]. An angled radiograph can also be fruitful. However it is a two-dimensional representation of three-dimensional object. It is therefore difficult to clearly determine the extra canals and their configurations. In such cases, advanced imaging techniques like dentascan, cone-beam computed tomography are very helpful [11,12].

Computerized tomography (CT) is very helpful in diagnosing various oral diseases. However, the presence of metallic restoration artifact, difficulty in positioning of CT gantry and the inability to obtain cross-sectional images diminishes its accuracy. Dentascan, a spiral computerized tomography or multiplanar reformation (SCT/MPR), eliminates all these shortcomings by processing axial CT scan information to get

actual cross-sectional images of the mandible and maxilla [13]. Using these techniques, uniformity of measurements and cross-referencing of anatomic structures in any plane of section in the entire three dimensions becomes feasible [6,14]. Surgical operating microscope is very useful in finding the extra canal orifices by providing enhanced visualization of pulp chamber floor and walls [15]. It is assumed that careful observation and inspection and tactile exploration of the pulp chamber floor and walls is mandatory to avoid the unexpected missing canal orifices that may cause failure of endodontic treatment.

4. CONCLUSION

Probability of missing additional root canals might lead to a greater failure rate. Therefore, a constant vigilance, perseverance and use of advanced techniques in diagnosis and treatment are required to deal with aberrant root canal systems.

CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this case report.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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