

Endodontic Management of Mandibular Premolars with Root Canal Vertucci Type II and III Configuration: Two Case Reports

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Abstract

The location of all root canals (RCs) and their adequate preparation, disinfection, and obturation play an important role in successful endodontic treatment (ET). Furthermore, in addition to normal RC system morphology, the operator should also recognize their anatomical variations. This study presented two cases of mandibular premolars with RC configuration Vertucci type II and III after a clinical diagnosis of irreversible pulpitis. RC preparation in two cases was performed using the crown-down technique. After following the standard irrigation protocol, the RCs were obturated using the warm vertical condensation technique. Knowledge of RC system variations, with their preparation and 3D obturation, is the appropriate qualification for ET. (*International Journal of Biomedicine*. 2023;13(2):346-349.)

Keywords: root canal • crown-down • vertical condensation • gutta-percha • mandibular premolars

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Abbreviations

ET, endodontic treatment; RC, root canal; WL, working length.

Introduction

An appropriate diagnosis, treatment plan, correct debridement, disinfection, and root canal (RC) system obturation are needed for successful treatment.⁽¹⁾ The RC preparation must be done without procedural errors while respecting the root canal's working length (WL) and maintaining its natural path.⁽²⁾ This can be achieved with the correct selection of instruments in terms of their size and design.^(3,4) Also, for a successful RC treatment the operator must have knowledge of internal RC morphology to locate

all RCs and properly clean, shape, and obturate the RC space in three dimensions.⁽⁵⁾ Despite all of this knowledge, RC preparation and obturation are still challenging due to the variety and complexity of RCs caused by different genetics, ethnicity, gender, and age, as well as the existence of lateral or accessory canals and isthmuses.⁽⁶⁾

Vertucci has identified eight different RC types, depending on their number and configuration.⁽⁷⁾ Due to this variability in RC morphology, endodontic treatment (ET) of lower premolars is a challenge for operators.⁽⁸⁾ Based on various population studies, the RC morphologies of the mandibular premolars mainly vary between Vertucci types I-VII.^(9,10)

Vertucci type II performs as two separate canals that leave the pulp chamber but join to form one canal at the exiting point; in Vertucci type III, one canal leaves the pulp chamber,

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divides into two within the root, and then merges to exit in one canal.⁽⁷⁾ These two RC configurations in lower premolars require proper preparation and obturation techniques to achieve 3D and hermetic obturation.

These two case reports describe the endodontic management of the second mandibular premolars with Vertucci type II and III, which were prepared with the crown-down technique and obturated with the vertical gutta-percha condensation technique.

Case Presentation

Case 1: A 50-year-old male patient came to the private dentistry clinic “Dr. Berisha” in Peja complaining that he had a toothache, followed by a sharp pain upon thermal stimulus, with lingering pain (often 30 seconds or longer after stimulus removal), spontaneity (unprovoked pain) and the frequency of referred pain increasing during the night.

The percussion, palpation, and thermal vitality test were negative. During RC exploration, the patient felt the pain and then was injected with infiltrative anesthetic Septanest 1:100.000 (4% Articain Hydrochloride with 1:100000 Epinephrine) (Septodont, Saint-Maur-des-Fosses Cedex, France) using Carpo syringe. The retroalveolar radiography revealed an intact periapical tissue with Vertucci type II configuration of the RC. Tooth 45 (lower right second premolar) had a deep cavity. This tooth was diagnosed with symptomatic irreversible pulpitis.

Before the treatment, the patient was informed that his clinical information and radiographic images may be reported in the journal. Therefore, the authors certify that they have obtained patient consent, and the patient was informed that his name and initials would not be published. ET was performed with a rubber dam. After caries were removed, access to the cavity was prepared, and two RC orifices were localized. Loupes with 3.0 magnification (Univet Loupes Spa, Rezzato, Italy) were used for canal localization. The RCs were explored with sizes 06, 08, and 10 K-files (DiaDent, France). WL was set at 1mm from the apical foramen. The pulp tissue was removed, and the RCs were prepared with E-flex gold rotary files (Eighteeth Medical Technology, Changzhou, China) using the crown-down technique. During shaping and cleaning, the operators used 17% EDTA gel (Cerkamed, Stalowa Wola, Poland). After opening the pathway with hand files 06, 08, and 10 K-Files (DiaDent, France), the operators used E-flex gold rotary file size 19/04 followed by size 20/04. Each canal's orifice was expanded with E-flex gold rotary file size 17/08 and finished with E-flex gold rotary file size 25/04. Apical enlargement was performed with an E-flex gold rotary file size up to 25/04. During the ET, the operators used the endodontic handpiece E-connect S (Eighteeth Medical Technology, Changzhou, China) at a rotation of 350rpm and torque 2.5Ncm, introducing the instrument passively into the RC. The RCs were irrigated following Marcus Haapasalo's protocol and using Irriflex, a flexible RC irrigation needle (Produits Dentaires SA, Vevey, Switzerland). During the shaping and cleaning of each canal, the operators performed irrigation with 2 ml of 5.25% sodium hypochlorite activated

with an ultrasonic device Ultra X (Eighteeth Medical Technology, Changzhou, China) for 30 seconds in each canal. After shaping and cleaning, the operators continued with 3 ml 5.25% NaOCl (Cerkamed, Stalowa Wola, Poland) with 30 seconds activation and 1ml EDTA 17% for 1 minute activated with Ultra X. They repeated the process with 2 ml 5.25% NaOCl in each canal with activation for 30 seconds and 1ml 17% EDTA with 30 seconds of ultrasonic activation. The drying was performed with Paper points.

The RC-WL was verified with radiography, followed by obturation of the RCs with vertical gutta-percha condensation using Fast Pack and Fast Fill (Eighteeth Medical Technology, Changzhou, China). The gutta-percha size was 25/04 (DiaDent, France) and was used in combination with Sealapex sealer (Kerr Corporation, Orange, CA, USA). ET was completed in one visit (Figure 1A-F).

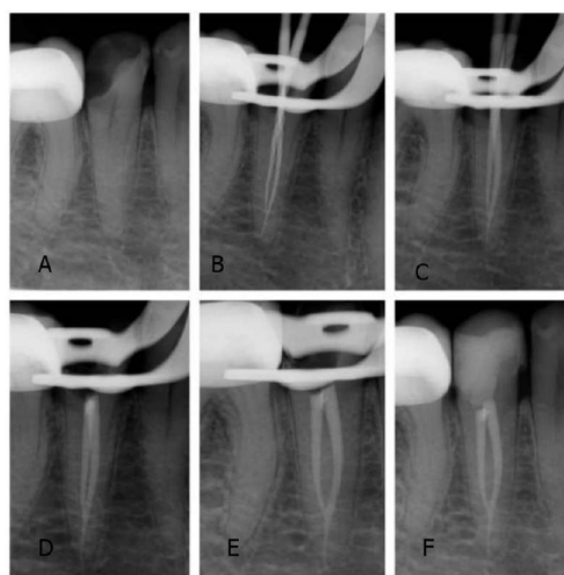


Fig. 1. A. First diagnostic radiography; B. Working length determination; C. Verification of working length; D. Radiography after root canal obturation; E. Radiographic image from another view; F. Coronal filling.

Case 2: A 30-year-old female patient came to the private dentistry clinic “Dr. Berisha” in Peja complaining of a toothache, followed by sharp pain, spontaneity (unprovoked pain), and the frequency of referred pain increasing during the night.

The percussion, palpation, and thermal vitality test were negative. Tooth 45 was under a porcelain crown. The porcelain crown was removed. During RC exploration, the patient felt the pain and then was injected with infiltrative anesthetic Septanest 1:100.000 (4% Articain Hydrochloride with 1:100000 Epinephrine) (Septodont, Saint-Maur-des-Fosses Cedex, France).

The retroalveolar radiography revealed an intact periapical tissue with Vertucci type III configuration of the RC. This tooth was diagnosed with symptomatic irreversible pulpitis. Endodontic treatment was performed with a rubber dam.

After the removal of the old filling and caries, access to the cavity was prepared, and one RC orifice was localized. It was divided into two canals within the root and then merged to exit in one canal. Loupes with 3.0 magnification (Univet Loupes Spa, Rezzato, Italy) were used for canal localization. The RCs were explored with sizes 06, 08, and 10 K-files (DiaDent, France). WL was set at 1mm from the apical foramen. The pulp tissue was removed, and the RCs were prepared with E-flex gold rotary files (Eighteenth Medical Technology, Changzhou, China) using the crown-down technique. During shaping and cleaning, the operators used 17% EDTA gel (Cerkamed, Stalowa Wola, Poland). After opening the pathway with hand files 06, 08, and 10 K-Files (DiaDent, France), the operators used E-flex gold rotary file size 19/04 followed by size 20/04. The canal's orifice was expanded with E-flex gold rotary file size 17/08 and finished with E-flex gold rotary file size 30/04. During the ET, the operators used the endodontic handpiece E-connect S (Eighteenth Medical Technology, Changzhou, China) at a rotation of 350 rpm and torque 2.5 Ncm, introducing the instrument passively into the RC. The RCs were irrigated using Irriflex, a flexible RC irrigation needle (Produits Dentaires SA, Vevey, Switzerland).

The operators performed irrigation with 2ml of 5.25% sodium hypochlorite (Cerkamed, Stalowa Wola, Poland) activated with an ultrasonic device Ultra X (Eighteenth Medical Technology, Changzhou, China) for 30 seconds in each canal. After shaping and cleaning, the operators continued with 3ml 5.25% NaOCl with 30 seconds activation and 1ml EDTA 17% for 1 minute activated with Ultra X. They repeated the process with 2 ml 5.25% NaOCl in each canal with activation for 30 seconds and 1ml 17% EDTA with 30 seconds of ultrasonic activation. The drying was performed with Paper points. The RC-WL was verified with radiography, followed by obturation of the RCs with vertical gutta-percha condensation using Fast Pack and Fast Fill (Eighteenth Medical Technology, Changzhou, China). Gutta-percha size was 30/04 (DiaDent, France), and the sealer Sealapex (Kerr Corporation, Orange, CA, USA) was used for obturation. After the ET of tooth 45 was completed, a new porcelain crown was made (Figure 2 A-F).

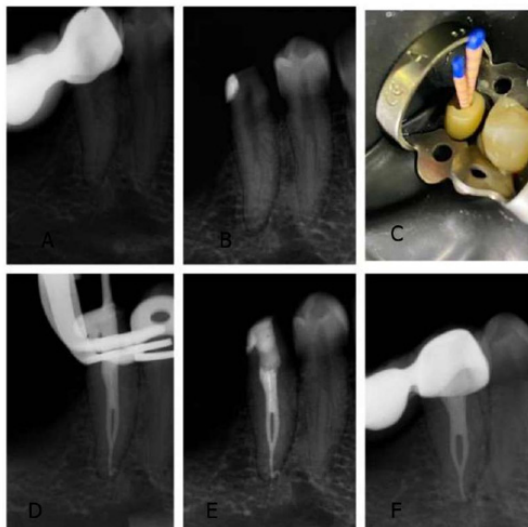


Fig. 2. A. Initial radiography; B. After crown removal; C. Root canal obturation; D. Radiography after obturation; E. Coronal seal; F. Porcelain crown.

Discussion

RC preparation is the critical step for RC obturation therapy, including RC cleaning and formation. Before RC preparation, the location, length, shape, and number of RC orifices need to be determined.⁽¹²⁾

Therefore, the upgraded knowledge of RC anatomy, combined with contemporary endodontic instruments, preparation and obturation techniques, and magnifications, may improve the success of ET.⁽¹³⁾

Mandibular premolars are also considered among teeth that are challenging in RC preparation and obturation. Previous studies have reported that the incidence of the first mandibular premolar is most commonly one root with one canal and ranges from 75.8%–97.9% cases, whereas two or more apical foramina were found in 21.1%–24.2 % cases with different morphology according to Vertucci types.^(14,15) Further, it has been reported that the second premolar usually has one root with a single RC system that ranges from 65% to 100% of cases, but many studies have also reported that the single root with two canals was observed in 1%–11% of cases, with a single apical foramen in 91.8%, or two or more apical foramina in 8.2% of cases.^(14,15) The choice of RC preparation technique depends on the design and shape of the instruments and RC system anatomy.⁽¹⁶⁾ The crown-down technique has been reported to be superior to other preparation techniques for curved RCs since this technique ensures access to the full WL, with minimal apical transportation from the natural path or reduction of the apical blockage and disables extrusion of canal content beyond apical foramen.⁽¹⁷⁾ According to obturation techniques, the vertical compaction technique ensures the adaptation of plasticized obturating material to the RC abnormalities, accessory canals, and isthmuses and produces consistently dense, dimensionally stable RC fillings more effectively than with cold gutta-percha.^(18,5) After heat application, gutta-percha can move apically and laterally through compaction pressure, ensuring three-dimensional obturation of RC space.⁽¹⁹⁾ Thus, poor cleaning and shaping and short or beyond apex obturated RC may cause the failure of ET, thus resulting in periapical lesions.^(20,21)

In our two case reports, the crown-down technique was carried out using E-flex gold rotary files produced by Eighteenth Medical company with handpiece E-connect S at a rotation of 350 rpm, resulting in adequate preparation of RCs without procedural errors, which, after irrigation with sodium hypochlorite 5.25% and EDTA, were obturated with vertical gutta-percha condensation using Fast Pack and Fast Fill. The results were very satisfactory, but they need to be followed up to determine if the preparation and obturation technique is successful.

Conclusion

Based on the results of two reported cases, it may be concluded that the operator's knowledge of RC anatomy, and visualization of it using radiography, combined with adequate preparation (crown-down) and obturation (warm vertical condensation) technique, will lead to the correct diagnosis and successful RC treatment.

Competing Interests

The authors declare that they have no competing interests.

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