Endodontic Management of a Rare Abnormal Anatomy in Mandibular Second Molar: A Case Report

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Abstract

We all seek success and perfection during endodontic treatment. To gain perfection one must know the goal of endodontic treatment. The main aim of endodontic treatment is to ensure that there is absence of infection and complete healing occurs, while the overall long-term goal is the placement of a definitive, clinically successful restoration and preservation of the tooth. Moreover, a detailed knowledge of usual root canal anatomy and its variations pertaining to every tooth is a must to ensure clinical success. This case report presents a permanent right second mandibular molar with distal root and mesial root fused at the apical parts, having three canals, one in distal root and two canals in mesial root, with pulp complexity at the apical part of the two fused roots.

Keywords

- endodontics
- mandibular second molar
- apical periodontitis
- root canal anatomy
- variations

Introduction

As dentists are becoming increasingly aware that natural teeth function more efficiently than any artificial replacement, they found it worth the additional effort to retain pulpally involved teeth. In the practice of dentistry, the role of endodontics has greatly broadened in scope in the past 40 years. Although many factors are responsible, the most important reason behind this growth is the extremely high predictability of endodontic success.[1] The aim of endodontic therapy is the reduction or elimination of pathogens from the root canal space and the prevention of any sort of recontamination after the treatment.[2,3] The success of a root canal treatment is based on cleaning, shaping, and sealing the root canal system that must be in three dimension (3D), what is known as modern endodontics.[4]

Modern endodontic practice is not concerned anymore with the old cliché of cleaning, shaping and filling, but with shaping first, to open the canals wide, so that cleaning can be effectively performed prior to 3D filling.[5] The main goal of modern endodontics is to decrease as much as possible of the intracanal bacterial load and dissolve all vital or nonvital pulp tissues, which cannot be done by only shaping of the canal.

Research of the morphology of the pulp has shown the wide variety of shapes and the occurrence of two or even three canals in a single root. There is a high incidence of fins, which run longitudinally within the wall of the canal and a network of communications between canals lying within the same root.[6] Therefore, we have many areas of interest, which are deep areas inside the canal and complex canal space in addition to a lot of debris, which are created during shaping of the canal. We can reach those spaces and clean the intracanal debris only with a 3D cleaning that may be effectively performed prior to 3D obturation.

Lesions of endodontic origin, which appear radiographically as areas of radiolucency around the apices or lateral aspects of the roots of teeth, are, in most cases, sterile.[7,8] The

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lesions are the result of toxins produced by microorganisms lying within the root canal system.[5] This finding suggests that the removal of microorganisms from the root canal followed by root filling is the first treatment of choice, and that periradicular surgery, including an apicectomy with a retrograde filling, can only be second best.[9] Thus, the concept of 3D cleaning holds a major significance.

This case report presents a permanent right second mandibular molar with periapical pathosis, distal root and mesial root of which were fused at the apical part of the two roots, having three canals, one canal in distal root and two canals in mesial root (type II Vertucci: two separate canals leave the pulp chamber but join to form one canal to the apex.) with pulp complexity at the apical part of the fused roots.

Case Report

A 35-year-old female patient was referred from a private practitioner to our clinic with the chief complaint of an intense throbbing pain in the jaw. According to the patient, pain was related to lower right jaw, which got worse on lying down and spread to jaw, neck, and ear. The patient was already carrying a panoramic radiograph (►**Fig. 1**) that revealed previously endodontically treated lower right second molar with two roots, fused at apex. There was a history of first molar extraction few years back.

Radiopaque filling material (presumably an intracanal medicament) was evident inside canals and a well-defined radiolucency at apex was evident too. Also, a radiolucent lesion was observed at the apex of second premolar. On clinical examination, composite restoration was seen on the molar and patient had no response to hot, cold, and electric pulp testing on both teeth while patient felt horrible pain on horizontal and vertical percussion on lower right second molar. Clinical and radiographic examination suggested symptomatic apical periodontitis on lower right second molar and asymptomatic one on lower right second premolar. It was planned to start treatment on lower second molar first to subside patient's pain.

In the first visit, under nerve block anesthesia (articaine hydrochloride 4%; Septodont, Saint-Maur-des-Fossès Cedex, France) and rubber dam (Sanctuary Health SDN BHD, Chemor, Perak, Malaysia) isolation, root canal treatment was initiated in #47. With the help of an endo-access bur

Fig. 1 Preoperative orthopantomograph.

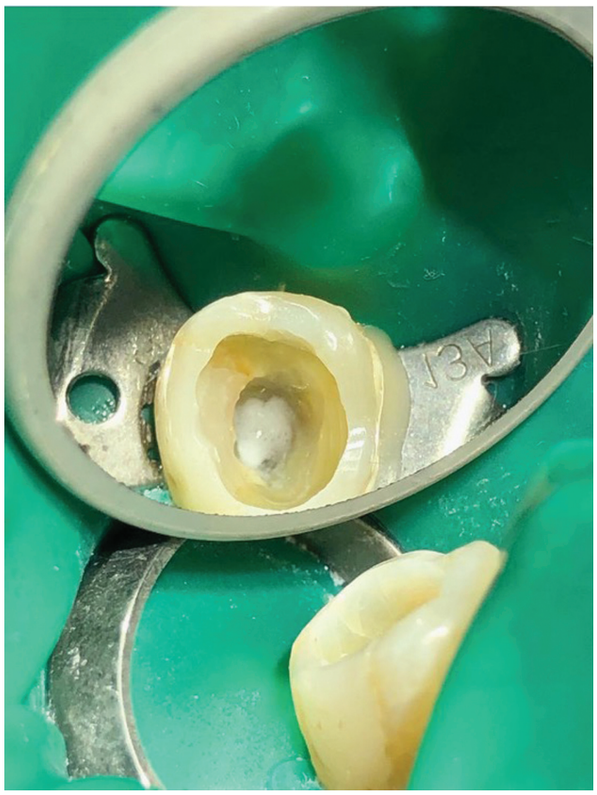

Fig. 2 Pus discharge seen from the canals.

(Dentsply, North Carolina, USA), an access cavity was made after removal of old composite restoration and cotton pellet and three orifices were located. A lot of pus was seen coming out of three orifices (►**Fig. 2**) , irrigation was made by hot saline in the beginning till blood started oozing out and use of sodium hypochlorite (NaOCl; 2.5%) was initiated when all exudate stopped coming out of three canals.

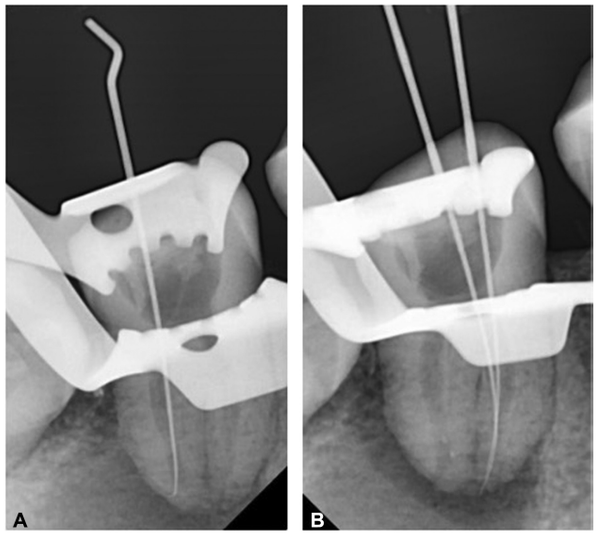

Fig. 3 Working length determination.

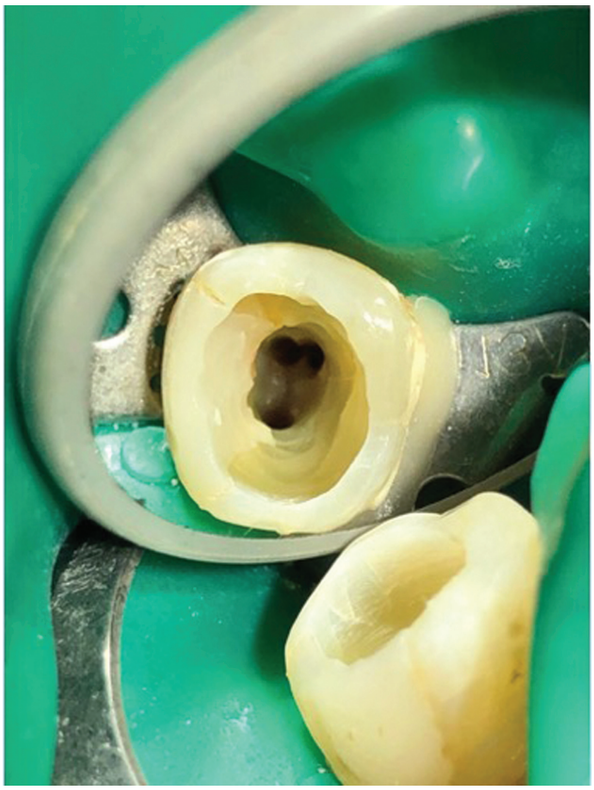

Fig. 4 Prepared root canals.

The working length was found to be 20 mm in three canals with an apex locator (E-PEX pro, Changzhou Sifary Medical Technology Co., Ltd, Changzhou City, Jiangsu, China). Working length radiographs were also taken to verify the same (►**Fig. 3A** and **B**). Biomechanical preparation was done reaching #35/.04 as master apical file (Sone Blue Fanta AF rotary file, Shanghai Fanta Dental Materials Co., Ltd, Shanghai, China) after checking previous instrumentation by #30 manual file (K-files, Mani Inc., Tochigi, Japan). A copious NaOCl (2.5%) irrigation was done during each instrumentation change. This completely removed the intracanal medicament paste present previously in the root canals. The access cavity was temporized with Coltosol F (Coltène/Whaledent AG, Altstätten, Switzerland), and a second visit was scheduled after 2 days for further management to observe if any exudate was still there.

In the second visit, patient reported with no signs or symptoms; clinically there was no pain on percussion and all symptoms had subsided. On reentering into the access cavity, very small amount of exudates was observed. A copious NaOCl (2.5%) irrigation was done and ultrasonic activation (U600, Guilin Woodpecker Medical Instrument Co., Ltd, Information Industrial Park, Guangxi, P. R. China) of NaOCl using E66 tip (Woodpecker) was performed. All the canals were dried using #35.04 paper points (Fanta, Shanghai Fanta Dental Materials Co., Ltd, Shanghai, China) (►**Fig. 4**). Calcium hydroxide (Well paste, Vericom Co., Ltd. Gyeonggi-do, South Korea) was placed as an intracanal

Fig. 5 Calcium hydroxide placed as an intracanal medicament.

medicament (►**Fig. 5**). The access cavity was temporized with Coltosol F, and a third visit was scheduled after 15 days.

In the third visit, patient was completely asymptomatic. Removal of calcium hydroxide was done by copious use of NaOCl (2.5%) irrigation.

Irrigation by ethylenediaminetetraacetic acid (EDTA) solution 7% (MD-Cleanser, META BIOMED CO., LTD, Chungcheongbuk-do, Korea) was done to remove smear layer to allow entrance of NaOCl inside dentinal tubules during intracanal heating and activation for cleaning, moreover, killing bacteria inside dentinal tubules. This was followed by irrigation by saline. Thereafter, NaOCl was placed in the canal and intracanal heating of NaOCl was done at 180°C with System-B heat source for 6 to 8 seconds followed by its ultrasonic activation. The process was repeated for four

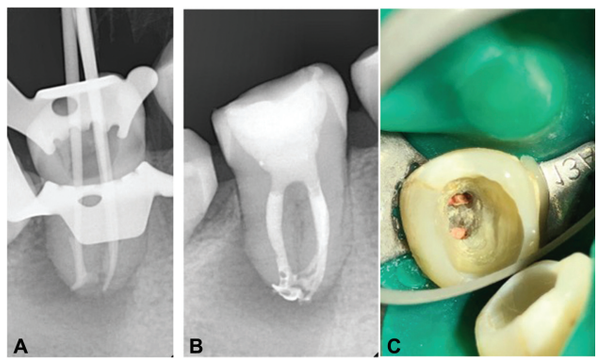

Fig. 6 (**A**) Master cone fit radiograph. (**B**) Radiograph showing three-dimensional obturated root canal system. (**C**) Clinical photograph showing obturated root canal system.

Fig. 7 Follow-up review radiograph.

to five times after refreshing NaOCl after activation. The canals were then irrigated with normal saline. Finally, irrigation by 7% EDTA solution was done to enhance bond between sealer and dentine, followed by saline irrigation and drying of all canals using paper point.

Obturation was performed using thermoplasticized gutta percha (Free fill, Denjoy Dental Co., Ltd. Changsha, P.R. China) and thus the apical complexity for both roots was filled successfully (►**Fig. 6A–C**). Follow-up review radiograph (►**Fig. 7**) after 20 months revealed promising healing and patient was asymptomatic.

Discussion

All the instrumentation techniques in endodontics rely on the use of irrigants to help flush debris from the canal. The ideal irrigant should be nontoxic, capable of dissolving both vital and necrotic pulp tissue, kill bacteria, lubricate, and remove the smear layer.[10–17]

The most common intracanal irrigant used is NaOCl. Other irrigants that have been studied alone or in combination with NaOCl include 3% hydrogen peroxide, EDTA, citric acid, and lactic acid.[17–26] NaOCl has been shown to be an effective antimicrobial agent when placed in contact with bacteria.[27–29] However, bacteria are never eliminated because a sufficient volume of irrigant does not reach all aspects of the canal space or dentinal tubules.[30] Hence, the 3D cleaning is required.

Currently, NaOCl is the most commonly used irrigant because of its numerous advantages (antimicrobial action, the ability of the solution to dissolve vital and necrotic tissue, lubricating action, mechanical flushing of debris from the canal, low cost, and availability).[4] Although NaOCl is a highly effective antimicrobial agent, it does not remove the smear layer from the dentin walls.[31] Instead, EDTA is appreciated for its ability to chelate hard tissue and for its decalcifying action.[4]

3D cleaning contains three important steps that are not expensive and does not require an apical preparation to large diameter to ensure a successful endodontic treatment. The three key steps are intracanal heating of NaOCl at 180°C for 6 to 8 seconds, ultrasonic activation of NaOCl, and/or subsonic activation of NaOCl.

Ultrasonic activation consists of activation of irrigants by ultrasonic tips (25–40 KHz). This technique allows, through a phenomenon called acoustic streaming, an intense stirring of the irrigant, which provides better antibacterial activity and a greater dissolution of the tissues.[32] Conversely, the limits of this technique are passivity and irrigation extrusion beyond the apex.[33] Sonic activation consists of the activation of irrigants by sonic tips. Ultrasonic activation has been shown to exhibit superior results in the entire length of the root canal and better dentin penetration in the apical third.[34]

The antibacterial effectiveness of NaOCl is affected by its concentration, volume, contact time, and temperature in the root canal.[35] Although results from previous studies have shown that high concentrations of NaOCl are needed for the elimination of bacteria, 2.5& NaOCl is still the most preferred concentration used in routine endodontic procedures. Other than changing its concentration, one alternative approach to improve the effectiveness of NaOCl irrigants could be to elevate the temperature of the solutions. This appears to improve its immediate tissue-dissolution capacity as well as its effectiveness in removing organic debris.[36–38] The final irrigation protocol based on intracanal heated NaOCl at 180°C with System-B Heat source has shown better results than preheated NaOCl at 50°C in obtaining clean canal walls. Without the use of EDTA as an irrigating solution, the heated NaOCl at 50°C alone can leave a higher quantity of debris and smear layer along root canal walls.[39]

The ideal 3D cleaning without 3D obturation cannot increase the success rate of endodontic treatment. The ideal 3D cleaned complex endodontic spaces must be filled by 3D obturation to ensure the high predictability of endodontic success. Gutta-percha is by far the most universally used solid core root canal filling material used in root canal treatment. It exists in two phases, α and β phase. When heated, it exists in α phase, which is tacky, sticky, and noncompatible. However, when cooled down to β phase, shrinkage occurs, and the degree of shrinkage is always greater than the degree of expansion.[40]

The purpose of obturating the prepared root canal space is to eliminate all avenues of leakage from the oral cavity or the periradicular tissue into the root canal system and to seal within the system any irritants that cannot be fully removed during canal cleaning and shaping procedures.[41] When the two dimensional radiographic appearance of root canal is unacceptable and leakage is high, then the importance of 3D obturation comes to play. The 3D obturation leaves no space for the lateral canal to hide.[42]

It is easy and effective technique to perform a good 3D cleaning by internal controlled heating of NaOCl, ultrasonic and/or sonic activation. Advantages of this technique are deep cleaning, more powerful pulp dissolution, less debris, cleaning of lateral anatomies, deeper penetration inside dentinal tubules, and conservative shaping to save more dentine.[39]

Conclusion

The endodontic space is not just a path in one way. It is full of complexity, pulp tissues, bacteria biofilm, and shaping debris. An easy and effective technique to perform a good 3D cleaning is by internal controlled heating of NaOCl and use of ultrasonic and/or sonic activation. Advantages of this technique are deep cleaning, lower viscosity of NaOCl, more powerful pulp dissolution, less debris, cleaning of lateral anatomies, deeper penetration inside dentinal tubules, and conservative shaping to save more dentine.3D obturation is the best way to fill 3D cleaned spaces. Overall, 3D thinking is necessary in modern endodontics.

Conflict of Interest
None declared.

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