



ENIGMA OF ENDODONTICS: MORPHOLOGICAL ODDITY OF MANDIBULAR PREMOLARS

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ABSTRACT Endodontics often challenges the clinicians with aberrant canal configurations which not only makes arriving at the accurate diagnosis puzzling but also alters the treatment approach. To achieve success after root canal treatment, a thorough knowledge of the usual root canal anatomy and its variations pertaining to each tooth with adjunctive diagnostic aids is of paramount importance. This is one such case report presenting two unique examples of varied canal anatomy. One is a mandibular first premolar displaying Vertucci Type III canal configuration and other is a mandibular second premolar with Vertucci Type V canal configuration. This report further describes in detail the complete treatment strategy from diagnosis to 3 – dimensional obturation.

KEYWORDS : anatomical variation, canal configuration, mandibular premolars

INTRODUCTION

Mandibular premolars have been reported with complex anatomical peculiarities, making them one of the most difficult teeth to manage endodontically.¹ Teeth that present with deviations in their internal anatomy are candidates for failed primary endodontic treatment, if an accurate diagnosis and management are not performed.²

It has been reported that 42% of retreatment cases are due to missed canals.³ Hence it is important to visualize and to have knowledge of internal anatomy of the offending tooth before initiating endodontic therapy.⁴ Variations in root and root canal morphology may be attributed to several factors including ethnicity, race, gender and the evaluation techniques.¹

Direct access to the buccal canal is usually possible, whereas the lingual canal may be very difficult to find. The lingual canal tends to diverge from the main canal at a sharp angle. In addition, the lingual inclination of the crown tends to direct files buccally, making location of a lingual canal orifice more difficult.⁵ With advancements in digital imaging, magnification, instrumentation, and disinfection, treating complicated root canal systems has become more predictable.

This case report describes the successful diagnosis and treatment of mandibular first and second premolars with Vertucci's Type III and Type V canal configurations respectively. Both the cases reported below were done using dental loupes with a magnification of 2.5x.

CASE STUDY

Case Report 1

A 53-year-old female patient with a noncontributory medical history reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the lower left back tooth region in the past 10 days. On eliciting pain history, she gave a history of sharp, spontaneous, and non-radiating pain with no aggravating or relieving factors.

On intraoral examination, a deep distoproximal caries was seen on tooth 34 which was rotated lingually. A previously root canal treated 33 was also noted. Tooth 33 showed no response while 34 was tender on percussion. On vitality testing, 34 showed no response to cold, heat and electrical pulp testing. On radiographic assessment, radiolucency involving pulpal space was detected with respect to (w.r.t) 34. Splitting of the main canal into two canals was clearly appreciated in the middle third of the root canal while beyond the split the tooth appeared calcified. A diagnosis of pulpal necrosis with symptomatic apical periodontitis w.r.t 34 was made and treatment plan was root canal therapy (RCT) followed by full coverage crown w.r.t 34.

A pre-endodontic build up was done and access opening was done under local anesthesia (2% Lignocaine with adrenaline, Xicaine – ICPA Health Products Ltd.) and rubber dam isolation using endo access bur (Dentsply Maillefer, Ballaigues, Switzerland). One canal splitting into two in the middle third of the canal was detected. The canals were calcified from middle third to the apical third of the root which was negotiated using C+ files (Dentsply Maillefer, Ballaigues, Switzerland). Working length was determined using 10 K files (Mani, Prime Dental Products Pvt. Ltd, India) and electronic apex locator (Root ZX Mini, J Morita). Glide path was established using ProGlider (Dentsply Maillefer, Ballaigues, Switzerland). Cleaning and shaping of the canals were done using Hyflex CM – 25/0.04 (Coltene) with EDTA as a lubricant (Glyde - Dentsply Maillefer, Ballaigues, Switzerland) and 3% sodium hypochlorite as an irrigant. Lingual canal was instrumented till the apex while the buccal canal was instrumented till the point of merging of the canals. Master cone fit was confirmed and obturation was done using single cone technique and AH plus sealer (Dentsply Maillefer, Ballaigues, Switzerland). Patient was recalled after 3 months for follow up. (As depicted below in Figure. 1)

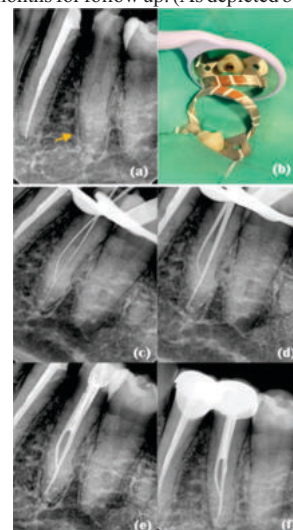


Figure 1. (a) Pre-operative radiograph (b) Access opening under rubber dam (c) Working Length Determination (d) Master Cone Fit (e) Obturation (f) 3 month follow up

Case Report 2

A 52-year-old female patient with a noncontributory medical history

reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the lower left back tooth region in the past 6 days. On eliciting pain history, she gave a history of sharp, continuous, and non-radiating pain which was sudden in onset, aggravated on intake of cold food or beverage with no relieving factors.

On intraoral examination, a deep distoproximal caries was found on tooth 35 which was tender on percussion. On vitality testing, 35 showed delayed response to cold, heat and electronic pulp testing. On radiographic assessment, radiolucency involving pulpal space was detected w.r.t 35. It was also noticed that the canal radiolucency was disappearing in the middle third of the root (fastbreak appearance). A diagnosis of symptomatic irreversible pulpitis with apical periodontitis w.r.t 35 was arrived at and the treatment plan was RCT followed by a full coverage crown w.r.t 35.

Access opening and working length determination was done as mentioned previously. One canal splitting into two in the middle third of the canal was detected. After establishing glidepath, cleaning and shaping of the canals were done till F1 Protaper Gold with EDTA as a lubricant and 3% sodium hypochlorite as an irrigant. Master cone fit was confirmed and obturation was done using same technique as the previous case. Patient was recalled after 3 months for follow up. (As depicted below in Figure.2)

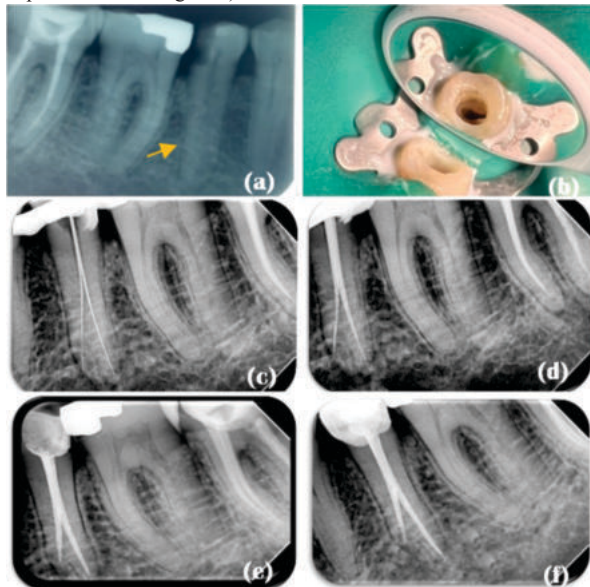


Figure 2. (a) Pre-operative radiograph (b) Access opening under rubber dam (c) Working Length Determination (d) Master Cone Fit (e) Obturation (f) 3 month follow up

DISCUSSION

The root canal is a complex system of finely tuned and synchronized small tributaries that may take many intricate shapes and configurations before reaching the tooth apex. The cause for such aberrations can be better understood through an insight into the development of root.

At a more advanced stage of tooth development, the root begins to form from a cellular diaphragm or horizontal Hertwig's epithelial root sheath. If the diaphragm remains in the shape of a collar, a single-rooted tooth will form. On the other hand, if two or three tongues of epithelium grow towards each other from this collar to bridge the gap and fuse, two or three diaphragms evolving independently from each other will form. They will either remain fused, forming fused roots, or single roots with multiple canals, or separated, forming distinct roots in multirooted teeth.⁶

Vertucci et al. (1986) revealed that the mandibular first premolars had one canal at the apex in 74.0% of the teeth studied, two canals at the apex in 25.5%, and three canals at the apex in the remaining 0.5% of the teeth. Only 12% of mandibular second premolars studied had a second or third canal. They also showed that the second premolar had one canal at the apex in 97.5% and two canals at the apex in only 2.5% of the teeth studied.⁷

Further, Sert and Bayrili (2004) surveyed differences in canal morphology based on gender, showing higher incidence (44%) of accessory roots and canals in females as compared with males (34%).⁸

In the Washington study conducted by Ingle, to assess the results of endodontic therapy, the mandibular first and second premolars showed a failure rate of 11.45 and 4.54% of all types of the teeth.⁹

Failure to recognize the presence of extra root or canals can often lead to acute flare-ups during treatment and subsequent post treatment disease.

- When to suspect presence of an extra canal?
- Fastbreak appearance – When you see a canal on a pre-operative radiograph that suddenly vanishes partway down the root.
- If a root contains only a single canal that canal will be positioned in the center or close to the center of the root.
- If a single canal is located initially on access preparation, an instrument should be placed in the canal and a radiograph must be taken either mesial or distal angulation. If the instrument is skewed considerably off center, the additional canal must be suspected.

Vertucci (2005) suggested diagnostic measures which aids in locating the presence of extra canals such as, obtaining angled preoperative radiographs, use of Cone Beam Computed Tomography, access cavity designs following Krasner and Rankow's laws, examination of the pulp-chamber floor with a sharp explorer, troughing of the grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite "champagne bubble test", visualizing canal bleeding points, use of magnifying loupes and microscopes and using fibro-optic transillumination are some of the few methods that should be made use of.^{4,10} This case report represents successful identification of the anatomical variations and treatment of the same.

CONCLUSION

The root canal system presents a myriad of complexities. While identifying such variations is a challenge itself, clinicians must be aware of the possibility of finding rare configurations and should use all the available diagnostic tools to avoid failure.

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