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A 24-year-Old Boy with Previously Treated and Aberrant Root Canal Anatomy in Mandibular Left First Premolar Tooth

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Abstract

Perfect cleaning and shaping is the key to successful root canal treatment. Therefore, a careful understanding of the internal anatomy and structure of the root canal system is an important factor when performing cleaning and cosmetic procedures. Mandibular premolars are among the most complicated teeth to treat with root canals due to their abnormal root canal anatomy. Furthermore, it varies in different ethnic groups. Therefore, it is needed to evaluate and search for an abnormal root canal anatomy in a failed root canal. In light of these observations, this case report provides a case of previously root canal treated mandibular first premolar tooth which was failed due to different root canal patterns. The tooth was subjected to re-root canal treatment and after completion of the therapy, the tooth was symptomless and patient was referred to the Department of Prosthodontics for a full veneer crown.

Keywords: Aberrant Anatomy, Mandibular Tooth, Premolar Tooth, Root Canal, Re-Treatment

Introduction

Successful results of endodontic treatment require a thorough knowledge of the internal anatomy and morphology of the endodontic system [1-2]. Due to the complexity of the endodontic system, there is a high risk of missing anatomy during endodontic treatment. It has been reported that 42% of missing canals or roots of teeth require retreatment [3]. Furthermore, the changes in the canal morphology are considered one of the most likely causes of inflammation and root canal failure. Therefore, untreated root canals can be associated with symptoms ranging from asymptomatic teeth to acute reactions to hot and cold stimuli, mild sensitivity to percussion, and/or palpation to acute abscesses. Mittal, *et al*. (2014) [4] stated that variations in the endodontic anatomy of mandibular premolars present endodontic treatment challenges for successful treatment. The incidence of roots and root canals in these teeth varies considerably in the literature. Zillich and Dowson (1973) [5] analyzed that 23.1% of mandibular first premolars had 2 or 3 root canals radiographically. Vertucci [6] found that 25.5% of 400 mandibular premolars had two apical foramens and 0.5% of teeth had 3 apical foramens. The shape of the root canal varies according to race. However, the dental literature is not unique in the study of ethnic and gender variation, as higher incidences of teeth with additional canals and roots have been reported in India, China, Australia, and sub-Saharan Africa, and the lowest incidences in West Eurasian, Japanese, and American Arctic populations [7]. Therefore, the root and root canal morphology of this tooth is needed for careful evaluation prior to root canal treatment due to the abnormal configuration of the root canal. In light of these observations, this case report provides a case of a previously root canal-treated mandibular first premolar tooth with different canal patterns and successfully treated with conventional endodontic treatment.

Description

A 24-years old male patient reported to the Department of Conservative Dentistry & Endodontics at Bangabandhu Sheikh Mujib Medical University (BSMMU) with the complaint of pain on the mandibular left first premolar tooth for two months. The patient had a history of root canal treatment on that tooth 1 year ago. On clinical examination, the coronal portion of the lower left first premolar tooth was found to have been filled with a temporary restorative material. The tooth was sensitive to

palpation and vertical percussion. On the vitality test, there was no response to the heat and cold test. The medical history of the patient was noncontributory. Intra-oral peri-apical (IOPA) radiograph findings Incomplete obturation was done on the mandibular left first premolar tooth along with widening of periodontal ligament space in the apical area (Figure 1A). The radiograph also showed that bifurcation of the canal in the middle third was missed during previous treatment. Based on the clinical and radiological findings, the tooth was diagnosed as having previously been treated and now having symptomatic apical periodontitis due to missed canal. The provisional diagnosis was apical periodontitis due to previously treat on mandibular left first premolar tooth with the missed canal.

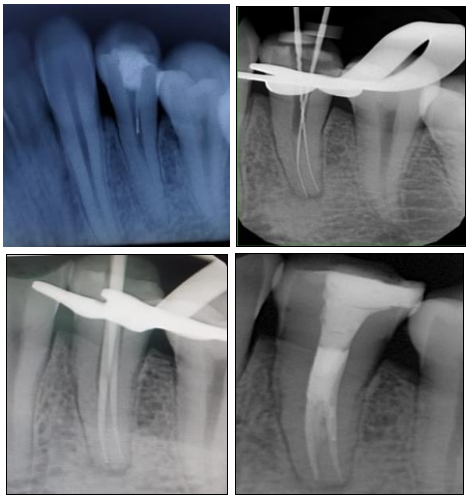

Fig 1: Pre-operative radiograph shows incomplete obturation on 34 no tooth along with widening of periodontal ligament space in apical area (A); Working Length determination X-ray shows bifurcation of canal in the middle third (B); Pre-obturation X-ray (C); Post-obturation X-ray (D)

Management

During the first appointment, at first the tooth was anesthetized using an inferior alveolar nerve block with 2% lignocaine HCL containing adrenaline, following isolation of the tooth and removal of the temporary filling material. After that, GP was removed by using the H file. Then the access cavity was modified with Endo-Z bur. Since the radiograph showed bifurcation of the root in the middle third, the access cavity was flared for easy access and visibility. The canal was negotiated using a size 10K file. Then a preserved size 10k file was placed and a second pre-curved size 10K file was placed along the side of the first file. After that radiograph was taken which confirmed the type IV weine canal configuration. Working length was confirmed both radiographically and by the apex locator. Cleaning and shaping were done using Protaper Gold rotary files (Dentsply-Sirona, USA) with the crown down technique using 2.5% sodium hypochlorite. Final irrigation was done with 5.25% sodium hypochlorite for 5 minutes followed by 17% EDTA for 2 minutes. After flushing with normal saline, the canals were soaked with 2% chlorhexidine for 1 minute. Then the canals were dried with paper points and calcium hydroxide paste was placed as an intracanal medicament. Access cavity was closed with a temporary restoration and the patient was recalled after one week.

At the next appointment, the patient was found to be asymptomatic, the temporary restoration was removed and calcium hydroxide was removed by flushing with normal saline followed by sodium hypochlorite. The final irrigation was done with 17% EDTA to remove the smear layer. The canals were obturated with the corresponding GP and seal apex sealer. Post obturation radiograph was taken to assess the quality of obturation following which a permanent restoration was placed. The patient was advised to follow up at 1, 3, 6, and 12 months intervals.

Discussion

This is a general belief that the development of apical periodontitis follows total pulp necrosis. This belief is based on the pulpal strangulation theory due to a generalized increase in pulpal interstitial pressure inside the uncompromised pulp space during pulpal inflammation that causes collapse of venules and cessation of blood flow [8]. In the case of symptomatic apical periodontitis, an inflammatory reaction occurs in the apical periodontal ligament. The blood vessels are dilated, polymorphonuclear leukocytes are present, and an accumulation of serous exudate distends the periodontal ligament and extrudes the tooth slightly. If the irritation is severe and continued, osteoclasts may become active and may break down the periradicular bone [9]. Periodontitis also may lead to periapical periodontitis. But in the present case, a patient came with the previously treated tooth endodontically, and missed canal was found there. It may be responsible for the development of apical periodontitis.

Regarding treatment method, thorough preoperative clinical assessment is the key step in trying to unfold any external or internal radicular aberrations [10]. Meticulous observation of the coronal and radicular anatomy and landmarks are prerequisites for the detection of variable anatomy. Radiographs provide much-needed information about root canal morphology. Accurate multiple preoperative radiographs, straight and angled views, using the paralleling technique are indispensable to provide clues about the number of roots [11]. A second radiograph 15 to 20 degrees mesial or distal to the horizontal long axis of the root, is necessary to accurately diagnose the number of roots and canals in premolar teeth [12]. A sudden change in radiographic density of the root canal space usually indicates an additional canal or a canal bifurcation [13]. Mart´ınez-Lozano *et al* [14]. have suggested a 40-degree mesial angulation of the X-ray beam to identify additional canals. CBCT is also a useful tool for the preoperative diagnosis of complex root canal anatomy [15].

Regarding working length, it is difficult to the radiographic interpretation of some accessory roots and their root apices due to their proximity to each other [16], and also there exists a possibility of superimposition by other roots. An apex locator is very useful in such cases and can be used to estimate the root canal lengths before a confirmatory working length radiograph [17]. If a working length file appears off-center on the radiograph, multiple canals should be suspected [18].

In biomechanical preparation, an important issue that has to be considered during the instrumentation of multiple canals in mandibular premolars is the presence of a sharp curve, especially in the bifurcation or trifurcation area [1]. Care should be taken during instrumentation along these sharp angles to prevent file separation. Preventive methods include the use of fresh instruments, frequent inspection of

files for distortion, preserving hand files, and the use of flexible Ni-Ti rotary and hand files.

Regarding dynamic irrigation, it is reported that in addition to the multiplicity of canals, the pulpal space of mandibular premolars also commonly contains isthmuses, lateral canals, apical ramifications, and other irregularities [19]. The use of adjuncts to cleaning and shaping in the form of passive ultrasonic irrigation, apical negative pressure irrigation devices, or other dynamic modes of irrigation could be useful in enhancing disinfection and cleaning the uninstrumented apical bi and trifurcations and lateral ramifications that are the most difficult to the instrument.[19] The use of an irrigation needle with a smaller diameter could result in enhanced irrigant flow into root canal irregularities [20].

In the case of obturation, root/root canal bifurcation or trifurcation can occur at the cervical, middle, or apical thirds of mandibular premolars. Obturation of these complex root canals may require technique modifications [21]. In the case of middle third Bi- or Trifurcation, enhanced magnification and illumination along with adequate coronal canal flaring to access the bifurcated canal orifices are recommended. When the coronal space is insufficient to accommodate multiple master cones at once, the larger master cone can be cut extraoral, at the level of the bifurcation or orifice. This shortened master cone can then be speared at the blunt, cut end with a spreader or a file in a clockwise rotation. The gutta-percha cone is then introduced into the canal, and rotating the file counterclockwise, using apical pressure, loosens the file. A plugger can then be used to compact the guttapercha. Care must be taken to prevent blocking of the unfilled canals by a sealer or remnant guttapercha by placing a paper point or a hand instrument within the canal that is to be filled later. The remaining canals can then be obturated similarly. After radiographic confirmation, backfilling of the coronal portion of the canal can be done [22, 23].

Conclusion

Occurrence of aberrant root canal anatomy in mandibular left first premolar tooth is a matter of diagnostic dilemma. Therefore, proper evaluation with follow up is advocated.

Conflict of interest

The authors declare no conflict of interest.

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