



Retrieval of Separated File in Mandibular First Premolar

Hussam Farrash¹ and Omar Alzahrani^{2*}

¹Department of Endodontics, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

²Department of General Dentistry, The University Dental Hospital, King Abdulaziz University, Jeddah, Saudi Arabia

***Corresponding Author:** Omar Alzahrani, Department of General Dentistry, The University Dental Hospital, King Abdulaziz University, Jeddah, Saudi Arabia.

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Abstract

This study shows the removal of broken fragment in the apical part of in mandibular first premolar. A patient was referred for restoring her broken lower right premolar. Her chief complaint was restoring the broken tooth with permanent restoration. Periapical radiography showed a broken file fragment in the apical part of the affected tooth. A CBCT scan was acquired and revealed the location and size of the broken fragment. The clinical examination showed that the tooth has been previously initiated, the tooth was tender to percussion. Thus, the nonsurgical root canal retreatment was done and the broken fragment was retrieved. The prognosis of this case is high because all canals were found and cleaned and shaped then obturated.

Keywords: Mandibular First Premolar; Periapical Radiography; CBCT; Root Canal Retreatment

Introduction

One of the most challenges in performing a root canal treatment is dealing with the complexity of the root canal morphology. Such challenges could affect our cleaning and shaping input, hence affecting our treatment outcome. Lacking knowledge about root canal morphology could lead to a lot of mishaps such as perforation, transportation, and file separation [1]. The complexity in root canal morphology differs from one person to another, and this could be due to different ethnic backgrounds [2]. Most studies show that the morphology of the mandibular first premolar has a single root canal with an average of (70 - 75%), two canals by almost (25 - 35%) and three canals by (0.5 - 2%) of the time [3-5].

The endodontic file instruments used nowadays are mostly made up of stainless steel and nickel-titanium. This might raise a chance that these files might separate at a certain point. It has been mentioned in a previous study [6] that the incidence of file separation is 0.25% for hand instruments and 1.68% for rotary instruments respectively, with an overall average of 1.66%. Moreover, most separations being in the apical third followed by the middle third. File separation can occur suddenly and by different loads of stress, whether it was cyclic or torsional failure [7,8].

Different various treatment methods for the separation could be by one of the following; first by retrieve the separated file surgi-

cally or non-surgically, second bypass the separated fragment and seal it within the obturation material, third leave it and obturate to the level of blockage or separation [9,10]. With the aid of advanced tools for file retrieval that includes: ultrasonic, microtube, and plier devices it made the management of such incidents easier. Also, with the help of a dental operating microscope (DOM) on the other hand which takes place on enhancing the visualization inside the root canal to prevent an excess amount of dentine shaving [11]. This report discusses the management of a file separation in the mandibular first premolar by using the ultrasonic device and file retrieval micro loops under the use of a DOM.

Case Presentation

A 29 years old female patient that was referred to the Endodontic department of King Abdul-Aziz University hospital with a chief complaint of restoring her broken lower right tooth, the patient gave a history of a previous root canal treatment that took place in the same tooth, and the treatment was done almost 4 months ago in a private clinic.

The patient was asymptomatic. Medical history as mentioned by the patient she is medically fit with no history of any illnesses or medications. Clinical examination showed a missed filling on the right first mandibular premolar, the tooth was slight tender upon

percussion, the intra-oral periapical radiograph (IOPA) showed a separated file the junction between middle and the apical third part of the root with no intracanal medicament nor obturation material inside the canals (Figure 1a and 1b).

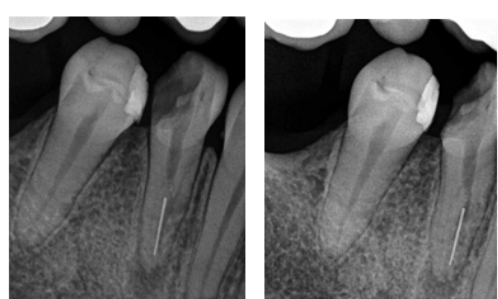


Figure 1: Preoperative radiograph. (a) Intraoral periapical radiograph with straight angulation (b) Intraoral periapical radiograph with distal angulation. Both x-rays shows the broken instrument inside the root canal.

The patient wasn't aware of the separated file nor that the tooth hasn't been fully treated, after explaining the treatment plan, the patient agreed to do a full RCT. After applying local anesthetic solution 2% of lidocaine with 1:100000 of epinephrine for nerve block, a rubber dam isolation was placed around a single tooth #44. The access cavity was prepared with the use of round bur and Endo Z bur, with the use of DOM Two canals were detected Buccal and lingual canals, the separated fragment was found to be in the buccal canal. A file size 10 was placed inside the buccal canal to measure the available root canal length and estimate the fragment location. An X2 and X3 ProTaper Next files (Dentsply Sirona) were used to widen the canal space to enhance both accessibility and visualization towards the separated fragment. After that, a staging platform was made by using modified gates gladden size 3 and 4 (Dentsply Maillefer, Balaguer, Switzerland) the gates gladden were modified by cutting the tips perpendicular to the long axes of the bur's cross-sectional. And, used to remove the surrounding coronal dentin portion around the fragment. Following with the use of Acteon Satelec P5 neutron ultrasonic generator with ultrasonic tips TFRK-S from the Terauchi File Retrieval kit (De Labs), they were used to trephine around the fragment. With the aid of magnification that was provided by DOM (X 2.5 magnification) (Zeiss, Germany). The ultrasonic tip was activated on a power setting of 3 during the

trephine procedure. Irrigation protocol by NaOCl 3% to clean and flush out the debris and EDTA 17% for lubrication, also these solutions will act as a coolant due to the heat that is being conducted by the ultrasonic use. An endodontic explorer was used to check the fragment dislodgment.

An endodontic explorer was used to check the fragment dislodgment, once the fragment got loose, a micro loop was placed inside the canal and locked on the fragment then a small gentle pulling up forces were applied to pull the fragment out from the canal. The fragment was retrieved and two K files size 10 were placed on both canals (Figure 2). After taking IOPA and confirming that the fragment was completely removed and both canals were completely patent. From the IOPA it showed that there might be a third missing canal as it showed a shadow that couldn't be identified as either a canal or an artifact from the periodontal ligament (PDL). A Cone-beam CT was taken for the patient to confirm the anatomy of this tooth as according to the American Association of Endodontics it is one of the recommendations in taking CBCT. It showed that the tooth had only two canals (Figure 3). The working length was confirmed with apex locator Root ZX II (Morita, Japan) cleaning and shaping of both the canals with ProTaper Next (Dentsply, Sirona) X2 and X3 files. Obturation of the root canal space by using X3 matching cone (Dentsply, Sirona) with hydraulic condensation technique. And the tooth was restored with a layer of cavit (Patterson Dental, St Paul, MN) that was covered with Fuji II (Henry Schein, Melville, NY) as a temporary filling (Figure 4a and 4b). Then the patient was referred to a prosthodontist to do the final coronal coverage.



Figure 2: After the broken file was removed and two k0file were inserted to check the working length.



Figure 3: CBCT with an axial view it clearly shows the two different canals that are present.



Figure 4: Intraoral periapical radiograph of the obturation after the cleaning and shaping of both canals. (a) Distal angulated radiograph (b) straight view.

Discussion

The complexity of the root canal system adds more challenges in retrieving a separated instrument, and it could be one of the most critical factors, to begin with. To understand the root canal morphology and geometry, lately, most studies are being conducted by the use of Micro-CT which is more reliable than any other technique [12]. Wolf, *et al.* found that most mandibular first premolar had a root canal configuration of 1-1-1 (Virtucci class I) in 70.6% and a configuration of 1-2-2 (Virtucci class V) in 4.6% of a sample of 109 mandibular first premolar in a mix Swiss-German popula-

tion [2]. In another middle eastern group, Alkaabi, *et al.* found that most mandibular first premolar had a single apical foramen 66% in a sample of 50 mandibular first premolar teeth and two apical foramens in 28%, three apical foramens in 6% [13]. Chourasia, *et al.* concluded in Saudi subpopulation that the first mandibular premolars commonly had a single canal 72%, two canals 26%, and three canals 2% [4].

In this case, the management was done by retrieving the separated fragment with the use of ultrasonic with the aid of microscopic magnification. Several factors must be taken into consideration for retrieving the separated instruments, for example, the location of separated file whether it was in the apical, middle or coronal part, under a curvature or in a straight canal. Alomairy, *et al.* stated that a more favorable outcome was found to be in removing fragments in less curved canals [14]. In this case, the separated fragment was found to be in the buccal canal which was straighter than the lingual canal. Also, the separated fragment was also located in the middle third of the root canal, not the apical third. Iqbal *et al.* investigated the level of separation and tooth type among other variables, he found that most separated files occur in mandibular teeth more than maxillary teeth and at the apical third level more than middle or coronal [6]. The visibility to locate and find the separated fragment plays a key role in a more successful outcome according to Navares, *et al.* as mentioned in their study, a successful outcome rate was predicted to be almost two times higher when the separated fragments were visible under the DOM [15].

Some factors can affect the treatment approach in either bypassing or retrieving the separated fragment. Most authors recommend bypassing the fragment when retrieval seems impossible or might cause damage to the root and end up with a perforation [16,17]. Ultra-sonics are the most common devices that are being used in retrieving the separated instruments. According to several authors the overall rate of success of such procedure weight an average of 88% success rate [18-21]. In the comparison between the ultrasonic to other retrieval kits, the differences weren't in favor of the retrieval kits as concluded by some authors [14,22]. Nevertheless, the use of DOM with magnification increases the chances of success up to 67%, according to Nagai, *et al* [23]. The more recent studies claim the success rate up to 90% [18,19]. However, taking into consideration that when ultrasonics are being used there are some factors to keep in mind when using this technique. It was shown that the prolonged use of ultrasonics will generate heat once it touches

the dentin wall as well as with the use of a high power setting [24]. To avoid this it has been suggested by Madarati, *et al.* to use a low power setting of (1.5) and no longer than a one minute use inside the canal [24]. The root canal space changes is another factor to keep in mind, the term which is referred to as volumetric changes, it was found that the most volumetric changes tend to occur in the apical third [25]. This means that when retrieving a separated file from the apical area, a large canal volume and less root mass are expected compared to the middle or coronal part [25].

The deeper the separation occurs the more removal of dentin will apply, hence enlarging the canal space. Another factor taking into consideration is the stress distribution on the tooth after removal of the fragment. According to Ni *et al.* a greater stress distribution occurred more in teeth that had undergone file retrieval procedure with the use of ultrasonic. When vertical and lateral loads were applied the greatest stress concentration was found to be in the straight-line access region [26]. If the separated files couldn't be able to retrieve or bypassed some authors suggest to leave them and obturate to the level of separation and follow up these cases, as they have shown a success rate of 95% when no lesion was presented while 88% when the lesion was presented [27,28].

Conclusion

Several factors need to be addressed when managing such cases, the dentist skills and experience play an important role in dealing with such cases. Also, having the right armamentarium can make the working environment less stressful, so that the procedure can be smoothly executed. If the separated file can be managed by less invasive approaches such as bypassing or surgical approaches, then it should be considered as the first option of treatment. The use of ultrasonic in such cases should be accompanied by the dental operating microscope or any other magnification device.

Data Availability

The data supporting this study can be accessed by readers freely through the availability of the same by the authors, as long as the patient's personal data is preserved. Images can be requested and notes from the medical record can also be viewed at any time, as long as there is no identification of the patient, as previously stated.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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