

Management of Intracanal Separated Instruments Using Ultrasonics: A Case Series

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ABSTRACT

Cleaning and shaping of the root canal system is an important step in non-surgical endodontic treatment. One of the mishaps associated with this step is intracanal instrument separation. Endodontic instruments separation often results from overuse or incorrect use. Such an event impedes shaping, disinfection and subsequent filling of the canal space apical to the instrument fragment. The use of ultrasonics has shown appreciable success for management of these cases especially when supported with magnification and illumination. With adequate knowledge, suitable armamentaria, fine clinical skills, and experience successful management of such cases, without further complications, is possible. If not well managed, intracanal separated instrument fragments adversely affect the long-term treatment outcome of endodontically treated teeth. This report presents three cases with intracanal separated instruments which were successfully managed with the use of ultrasonics under magnification with dental loupes.

Keywords: Instrument Separation, Retrieval, Root Canal Treatment, Ultrasonics

INTRODUCTION

Endodontic treatment outcome is highly dependent on efficient cleaning and shaping of the root canal system [1]. During cleaning and shaping Iatrogenic events like separation of an endodontic instrument may occur which if not managed result in procedural complications for the clinician. [1,2]. Intracanal Instrument separation results from excessive use of the same file, improper instrumentation techniques, inexperienced operator as well as manufacturing defects [2]. Intracanal separated instrument fragments if not managed inhibit proper root canal treatment beyond the fragment thus possibly leading to endodontic failure. Management of intracanal separated instrument is broadly categorized into two; the surgical and orthograde/non-surgical approach. Because of its lesser post operative complications, the orthograde approach is preferred over the surgical approach. Non-surgical management can be in the form of complete removal of the separated instrument fragment or bypassing it [3,4]. A number of instrument retrieval techniques have been discussed in literature [4,5]. Use of ultrasonics is one of the most common methods of separated instrument fragment removal. Special designed tips powered by ultrasonic machines are employed to generate

ultrasonic vibrations which are transmitted to the separated instrument fragment to loosen it and allow for its retrieval [5]. Use of ultrasonics has been reported to be a successful technique, nonetheless, if not optimally used complications can arise. Such include, root perforation, further fracture of the instrument fragment, separation of the ultrasonic tip within the canal and excessive removal of radicular dentin. The latter has been associated with decreased root strength making the root susceptible to vertical root fracture [6]. This case series highlights the management intracanal separated instruments with ultrasonics, with magnification and illumination provided by dental loupes.

CASE 1

A 34-year-old female patient was referred by her dentist for retrieval of two separated instruments. The first instrument was a size 20 stainless steel K file that had fractured in the mesio-buccal (MB) canal of tooth 36 during cleaning and shaping. The clinician successfully bypassed the instrument fragment. Thereafter, he proceeded to clean and shape with rotary instruments. One of the rotary instruments separated in the same canal. A preoperative radiograph revealed two instrument fragments located in the middle 3rd of the MB canal. After administering local anesthesia, lignocaine

with 1:80,000 epinephrine (Lidocaine, 2% E-80, New Static, S. A, Colombia), the tooth was isolated with rubber dam. A staging platform was created, using modified Gates Glidden burs (Dentsply Sirona, USA). An ultrasonic tip DTE ED87 mounted on DTE® D3 LED ultrasonic machine (Guilin Woodpecker Medical Instrument Co.,Ltd. China) was applied around the instrument in an anticlockwise manner to dislodge the first fragment. Similarly, the second fragment was retrieved using the DTE ED87 tip. Lubrication was provided by Ethylene Diamine Tetra acetic Acid (EDTA) solution (Prevest DenPro Limited, India). Illumination and magnification was provided by x2.5 dental loupes (Head Light II, SNAP, Taiwan).

After instrument retrieval, cleaning and shaping was done using Wave One Gold (Dentsply Sirona, USA). Irrigation was done using 2.5% sodium hypochlorite and normal saline.

Master cone radiograph was taken and obturation done using gutter percha and Ceraseal (MetaBiomed, Korea). Glass ionomer cement (3M Ketac™ Molar, 3M India Limited, India) coronal orifice seal was placed, and a composite restoration placed (Amelogen Plus, Ultradent Products, Inc. USA). The patient was sent back to the referring clinician for fabrication of an extra coronal restoration.



Fig.1: Pre-operative radiograph



Fig. 2: Radiograph, after retrieval of first fragment



Fig.3: Check radiograph confirming retrieval of both instrument fragments



Fig. 4: Obturation radiograph



Fig. 5: Picture showing one of the instrument fragments measuring 6mm in length

CASE 2

A 40-year-old female patient was referred by her dentist for retrieval of an intracanal separated instrument. The instrument was a Nickel Titanium rotary file that had separated during cleaning and shaping of the left maxillary 1st premolar. After administering local anesthesia, lignocaine with 1:80,000 epinephrine (Lidocaine, 2% E-80, New Static, S. A, Colombia), the tooth was isolated with rubber dam. A staging platform was created in the palatal canal, using modified Gates Glidden burs (Dentsply Sirona, USA). Thereafter an ultrasonic tip DTE ED87 mounted on DTE® D3 LED ultrasonic machine (Guilin Woodpecker Medical Instrument Co.,Ltd. China) DTE ED87 mounted were applied around the instrument in an anticlockwise direction and in presence of Ethylene Diamine Tetra acetic

Acid (EDTA) solution (Prevest DenPro Limited, India) to dislodge the instrument fragment. Illumination and magnification provided by x2.5 dental loupes (Head Light II, SNAP, Taiwan). After instrument retrieval, cleaning and shaping was done using Wave One Gold (Dentsply Sirona). Irrigation was done using 2.5% sodium hypochlorite and normal saline. Master cone radiograph was taken and obturation done using gutter percha and Ceraseal (MetaBiomed, Korea). The coronal orifice seal was placed using glass ionomer cement (3M Ketac™ Molar, 3M India Limited, India) followed by a composite restoration (Amelogen Plus, Ultradent Products, Inc. USA). The patient was sent back to the referring clinician for fabrication of an extra coronal restoration.



Fig. 1: Preoperative radiograph



Fig. 2: Clinical picture showing the dimensions of the staging platform at the level of the orifice

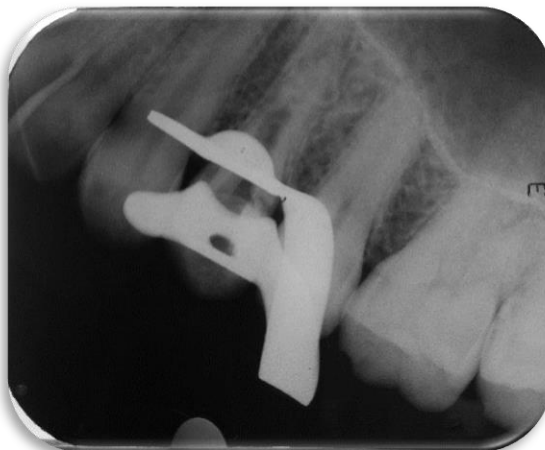


Fig 3: Check radiograph after confirming retrieval of instrument fragment

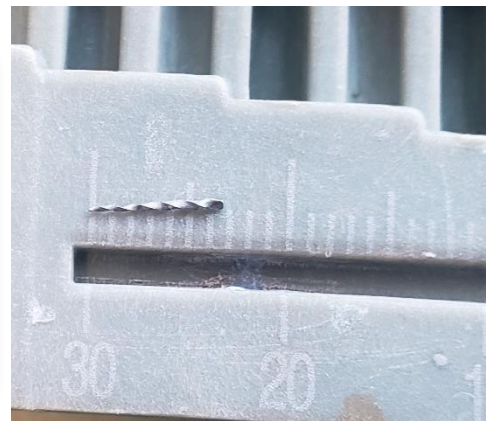


Fig. 4: Separated instrument fragment, measuring 6mm in length



Fig 3: Obturation radiograph

CASE 3

A 29-year old male patient was referred for retrieval of a separated instrument. Local anesthesia, lignocaine with 1:80,000 epinephrine (Lidocaine, 2% E-80, New Static, S. A, Colombia), was administered and the tooth isolated with rubber dam. A staging platform was prepared using modified Gates lidden burs (Dentsply Sirona) before an ultrasonic tip DTE ED87 mounted on DTE® D3 LED ultrasonic

machine (Guilin Woodpecker Medical Instrument Co.,Ltd. China) was used to retrieve the instrument fragment. the instrument fragment measured 9mm in length. Illumination and magnification was provided by x2.5 dental loupes (Head Light II, SNAP, Taiwan). A temporary restoration was thereafter placed using Orafil-G (Prevest DenPro Limited, India) and the patient sent back to the referring clinician for the completion of the root canal treatment.



Fig.1: Preoperative radiograph

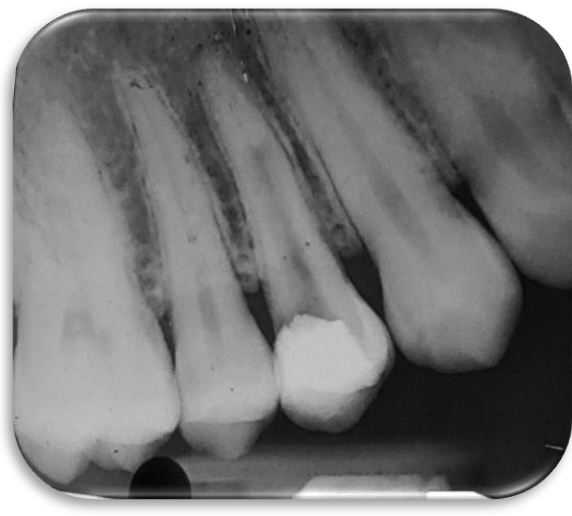


Fig.2: Check radiograph after instrument



Fig. 3: Clinical picture showing the dimensions of the staging platform at the orifice level and the retrieved instrument



Fig. 4: Separated instrument fragment retrieved measuring 9mm

DISCUSSION

Factors affecting separated instrument retrieval can be broadly categorized into three; Technical factors, environmental

factors and time factors [7]. When applying ultrasonics, technical factors include; ultrasonic activation in the wrong place, application of ultrasonics on the top of the

instrument fragment, use of larger diameter ultrasonic tips or use of greater taper ultrasonic tip. Time factors are related to having larger diameter and longer instrument fragments. Type of instrument fragment and presence of severe curvature are also important time factors. For Instance, retrieval of an austenitic phased file fragment around a curvature requires more clinical time. Environmental factors such as poor visibility and lack of lubricity within the canal ultimately affect the retrieval of separated instrument fragment [3,7].

In the case series presented, Case 1 had two separated instrument fragments within the same canal. The first instrument fragment was a K hand file. After successfully bypassing the first instrument fragment, the clinician employed a Ni-Ti rotary instrument to complete the cleaning and shaping process. The rotary instrument thereafter separated. The bypassing technique is grounded on the fundamental principle that root canals lack perfect roundness. This inherent anatomical feature, permits the careful passage of a smaller file through minute spaces around the separated fragment [8].

Intracanal separated instrument retrieval techniques come with appreciable amount of dentin sacrifice. This is evident radiographically in Case 2. Care should be taken minimize the radicular dentin lost during the retrieval exercise. Excessive loss of radicular dentin has been reported to reduce the strength of the root making it prone to vertical root fracture [6,9,10]. Other procedural errors associated with use of ultrasonic in retrieval of separated instrument fragments include perforation, transportation and formation of microcracks within dentin [9,10].

The instrument fragment in case 3 was a hedstrom file measuring 9mm in length spanning from the mid root to the apical region. Use of ultrasonic alone for longer instrument fragments >4.5 mm does not show much success. Ultrasonics are recommended to loosen the instrument and facilitate removal using other means for

instance loops, extractor microforceps, or microtubes. [11]. Still longer instrument fragments may loosen and spin out while using ultrasonics as evident in this case.

The retrieval of the separated instrument fragments in the three cases presented was performed in the presence of Ethylenediaminetetraacetic acid (EDTA) solution. EDTA, has low surface tension and facilitates instrument removal from the canal. Furthermore, it removes hard- tissue debris produced during ultrasonic activation paving the way for the instrument fragment [3]. Various fluid types can be used for ultrasonic instrument retrieval. These include, soybean oil, olive oil and corn oil [3, 12]. Fluids depend on features such as surface tension, viscosity and lubricity to be able to lubricate the fractured instrument fragment and flush it away with the help of ultrasonic acoustic streaming and cavitation [3].

For the three cases presented, magnification and illumination were provided by magnifying dental loupes. The use of a dental operating microscope or magnifying loupes guides the clinician during the instrument retrieval process minimizing damage to the radicular dentine. When the separated instrument fragment is visible, the success rate of its retrieval increases [13, 14].

CONCLUSION

The most effective way to prevent instrument separation during cleaning and shaping is to use the instruments carefully and correctly. If an instrument separation inadvertently occurs, management options include bypassing the fragment directly, bypassing it indirectly via another canal, or retrieving the fragment. The patient should always be informed of the instrument separation, the treatment plan and possible associated complications. Optimal use of ultrasonics supported by magnification and illumination has been proven to be a successful technique for retrieving intracanal separated instrument fragments.

Declaration by Authors

Ethical consideration: Verbal consent to take clinical pictures and use them for teaching and research purposes was obtained from the patients. Confidentiality and anonymity were ensured by omitting the identities of the patients.

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