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Periapical Healing Following Retrieval of a Separated Instrument in a Mandibular Molar - A Case Report

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Abstract

Instrument separation in the apical third of the tooth, which is associated with a large periapical lesion, presents an arduous task for the clinician. This case report presents nonsurgical endodontic management of a mandibular first molar associated with a large periapical lesion and a separated instrument in the apical third of the root canal. A 30-year-old male patient presented with pain in the right mandibular first molar region. Pulp sensibility testing showed no response. The radiograph revealed the presence of a separated instrument in the apical third of the root canal and periapical radiolucency with mesial and distal root. A diagnosis of previously initiated therapy with symptomatic apical periodontitis was made. In the first visit, instrument retrieval was done using ultrasonic. In the subsequent visit, obturation was done as the patient was asymptomatic. The successful outcome seen in this case shows that even

large periapical lesions can be managed conservatively by nonsurgical endodontic treatment.

Keywords: Root Canal Treatment, nonsurgical healing, Instrument Separation, File Retrieval, ultrasonics, apical third, long term follow-up.

Introduction

The success of an endodontic treatment depends on efficient shaping and cleaning of the root canal system [1]. Iatrogenic accidents like separation of an endodontic instrument may occur during shaping and cleaning causing procedural complications for the operator.

The risk of instrument separation in the canal is due to multiple use of the same file, inex perienced operator, improper technique of instrumentation and Manu facturing defects (2).

As super elastic nickel-titanium NiTi instruments introduced, the efficiency of endodontic cleaning and shaping has been greatly improved, especially in the curved canals. These instruments can minimize the procedural errors, such as ledge and transportation, and create more rounded/cantered canal preparation (3,4,5). However, the advent of nickel-titanium (NiTi) alloys has not resulted in a lower incidence of instrument separation (6, 7). Whereas separation rates of stainless steel (SS) instruments have been reported to range between 0.25% and 6% (8–11), the separation rate of NiTi rotary instruments has been reported to range between 1.3% and 10.0% as tensile and yield strength is lower to that of stainless steel. The clinical decision for management should be based on thorough knowledge of success rate of each treatment options, constraints of the root canal accommodating the fragment, the stage of root canal instrumentation at which the instrument separated, the expertise of the clinician, armamentaria available, possible associated complications, the strategic importance of the tooth involved, and the presence/or absence of periapical pathosis.

In the present case report, we demonstrate management of separated instrument in the mesiobuccal root canal of mandibular first molar by using ultrasonic along with six month follow up.

Case Description

A 30-year-old male patient reported to department of conservative dentistry and endodontics of a dental institute with no systemic diseases complaining of pain in mandibular right molar region. Extraoral tissues appeared normal. On intra-oral examination, tooth #46 and carious #47 was tender on percussion, for #46 endodontic treatment was initiated by a private practitioner four months back. The patient's overall periodontal health and occlusion were satisfactory. On vitality testing using a cold test (Endo Ice; Hygenic, Akron, Ohio) and electric pulp test (Analytic Technology, Leeder Ville, Australia), no response was elicited wrt tooth #46 and #47. A normal response was seen wrt tooth #48 and tooth #45. Radiographic examination revealed a separated endodontic instrument measuring about 5.5 cm in the apical third of the mesial root canal of mandibular first molar. Large periapical radiolucency (dimensions 11 ×11mm approximately) was associated with mesial and distal root of #46 and caries involving pulp with widening of periodontal space wrt #47. Based on the clinical and radiographic presentation, a diagnosis of previously initiated therapy with symptomatic apical periodontitis was made #46, # 47. The patient was informed about the separated instrument present in the tooth, and treatment options were discussed. The decision to attempt instrument retrieval followed by nonsurgical endodontic treatment was made. Informed, valid consent was obtained from the patient.

In the first visit, LA with Epinephrine 1:50,000 was administered, and rubber dam isolation was applied. Access cavity preparation was modified, and three canals were located, mesio-buccal, mesiolingual and distal canal. Working length determined with 10 k file. Bypassing separated instrument achieved by using K files (Mani) sequence: 08, 10, 15 and 20 (Figure 2 and 3). Neo endo flex rotary files (Oricam Healthcare Private Limited) was used then to instrument the canal till size 25.06. 3% Sodium hypochlorite (Septodont) was used with safety needle gauge 27 for the irrigation. The final irrigation was done with saline (0.9%), then canals were dried with paper point and a non-setting calcium hydroxide (Prime Dental RC Cal) was placed in the canals as intracanal medicament, and the tooth was closed with temporary filling. The patient was recalled after two week.

In the second visit, the follow up IOPA taken, the tooth was completely asymptomatic, no pain on percussion. The tooth was re-accessed under LA after placing rubber dam. The intracanal medicament was irrigated thoroughly with saline followed by irrigation with sodium hypochlorite 3% (Septodont) and saline. The orifices of both mesiolingual and distal root canals were closed with a paper point and Teflon tape to prevent the entry of file fragments.

In the mesiobuccal root canal, the retrieval started by making a staging platform with a Satelec ET20 ultrasonic tip (Satelec Acteon, Endo success retreatment kit, France) in counter clock wise direction in dry condition at the lowest power setting until 2 to 3 mm of the broken file was exposed. This was aimed at loosening the file from the root canal wall of the dentin and providing a space for the device.

The files are also susceptible to secondary heat if the ultrasonic tip is in contact with the file. Therefore, EDTA irrigation was conducted when the ultrasonic tip (Eighteeth Ultra –X Ultrasonic Activator) was activated at the lowest power setting. The instrument was loosened in the canal and moved in the coronal direction. On inspection, the fractured fragment was found to be NiTi rotary file. Straw-coloured discharge was evident from tooth #46 on instrument retrieval.

Irrigation was done using 5.25% sodium hypo chlorite (NaOCl) (Novo Dental Product, Mumbai, India), followed by 17% ethylenediaminetetraacetic acid (EDTA; Prevest Denpro Limited Digiana, Jammu, India). Canals were rinsed with normal saline in the end. The root canal was dried with sterile paper points, and calcium hydroxide dressing was placed in the canal space. The access cavity was sealed with a 3mm thick provisional restoration material (Coltosol F; Coltene, Altstätten, Switzerland), and the patient was recalled after two weeks.

The patient was completely asymptomatic on the recall visit. Provisional restoration was removed using #2 diamond round bur. Copious irrigation with 5.25% NaOCl followed by 17% EDTA was done. A final rinse with normal saline was done, and the canal was dried with paper points. Obturation was done with AH Plus Sealer and Gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland) using the lateral condensation technique. The access cavity was restored with composite resin (The patient was completely asymptomatic on the recall visit. Provisional restoration was removed using #2 diamond round bur. Copious irrigation with 5.25% NaOCl followed by 17% EDTA was done. A final rinse with normal saline was done, and the canal was dried with paper points. Obturation was done with AH Plus Sealer and Gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland) using the lateral condensation technique. The access cavity was restored with nano-hybrid

composite resin (Filtek Z250 XT; 3M ESPE, See Feld, Germany).

The patient was regularly followed up. At the three months recall visit, the patient was asymptomatic, and both teeth were functional. Osseous healing was evident peripherally on a six-month recall (Figure

Discussion

Teeth presenting with concomitant large periapical lesion and a fractured instrument in the apical third fall in the category of complex endodontic cases and often requires surgical intervention. However, surgical intervention should be done only when conservative treatment options fail. It has been observed that up to 94.4% of periapical lesions show partial or complete healing when managed with a conservative approach using nonsurgical endodontic therapy [5,6]. In this case as well, the nonsurgical endodontic treatment proved effective.

The presence of a separated instrument which is one of the most alarming complications occurring during endodontic treatment. The several attributing factors for instrument fracture are repeated usage of the instruments, instrument design, degree of canal curvature, and operator's experience

Instrument separation may occur with hand or engine driven instruments either due to cyclic fatigue, and/or torsional failure. Cyclic fatigue occurs when an instrument is rotated in a curved canal whilst undergoing multiple tensile and compressive stresses. Torsional failure occur when the tip of the file binds in the canal whilst the instrument continues to rotate. Generally, coronal fractures of instruments are more likely to be due to cyclic fatigue whilst apical fractures are more often due to torsional stresses. Stainless steel and hand instrument will generally separate due to torsional failure but engine-driven NiTi instruments will usually fail due to combination of torsional and cyclic fatigue.

The incidence of instrument fracture has been reported to be between 0.7 and 7.4%, it can be considered that root canal anatomy is a critical factor contributing to instrument fracture, due to curvatures frequently observed in mesial roots of molar teeth appear to be predisposed to this. Based on the current literature, mandibular molars are commonly affected teeth. Restricted access may act as a further complicating factor for same.

The main goal of management of separated instrument is not only retrieving the fragment but also preserving the integrity of the tooth. With the associated complications, bypassing a fragment located deep in the root canal or beyond the root curvature, if possible, maybe the alternative treatment option. A separated instrument itself is not the main cause of treatment failure but rather an indirect one, because it prevents adequate cleaning, shaping and filling of the root canal.

In this case our main goal was to remove the separated instrument to reach to the apical area which could be irrigated and cleaned thoroughly.

The treatment of cases with a separated instrument can be either conservative or surgical. A conservative approach involves the following treatment choices: a) bypass of the fragment, b) removal of the fragment, c) instrumentation and obturation coronally to the fragment.

Concerning the removal of a separated instrument, a variety of techniques and systems have been developed. Ultrasonics, in combination with the operative microscope constitute the most effective and reliable tools for removing a separated endodontic instrument from a root canal. The likelihood of successful removal depends on: the level of separation (coronal, middle or

apical third); location in relation to the root canal curvature; the type of separated instrument; its length; the degree of canal curvature and the tooth type.

Several complications may occur during the management of a separated instrument: separation of the ultrasonic tip or file used for bypassing or removing the instrument; further separation of the fragment; perforation; ledge; transportation; extrusion of the file into periapical tissues; tooth weakening due to dentin removal, as well as excessive temperature rise in periodontal tissues.

Prognosis for a tooth retaining a separated instrument depends on the presence of a periapical lesion, the microbial load of the root canal during the time of separation and the quality of the obturation.

When using ultrasonics, both immediate access and visual contact with the separated instrument are important. The use of an operative microscope limits the risk of the excessive removal of dentin and possible perforation. Ultrasonics tips are made of stainless steel, which are coated with diamond or zirconia. The coated tips burnish the dentin throughout their length, whereas the uncoated ones only remove dentin at their cutting edge. There are also tips made of titanium alloy which is considered to make them more flexible.

Especially small diameter and longer length tips are used to remove dentin around the fragment to loosen it and make it more easily removable from the root canal wall. During this process, the ultrasonic tips should move in the reverse direction of rotation to that of the instrument. It has been suggested that the use of citric acid or EDTA combined with ultrasonics, can help the removal of debris and smear layer from the grooves of the instrument and thus facilitate the fragment removal from the root canal. While using ultrasonics for instrument retrieval, it is important to activate it only when it is in contact with root dentin; otherwise, it might shred or push the separated instrument apically.

Attempting to bypass the fragment, partially or completely, minimizes the contact between the fragment and root canal walls and may even dislodge it. In addition, it provides enough space to introduce instruments such as ultrasonic tips alongside the fragment. Therefore, bypassing can be considered as an initial step toward a successful removal, because in most cases once bypassed, the fragment can be removed.

One of the potential drawbacks of the presented case is that cone beam computed tomography (CBCT) was not done postoperatively to confirm the healing of periapical lesion three-dimensionally. However, considering the socio-economic status as well as the clinical status of the patient, CBCT was not done.

Conclusion

Instrument retrieval is critical for the success of endodontic treatment, especially when the tooth is associated with a periapical lesion. This case report demonstrates a successful retrieval of a separated instrument from the apical third of the root canal with minimal damage to the radicular dentine. Also, the use of an advanced armamentarium can reduce the risk of mishaps or procedural errors while managing such complicated cases.

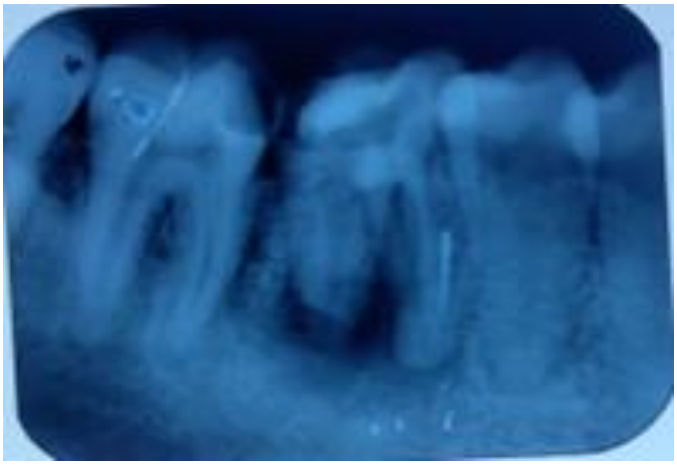

Fig a

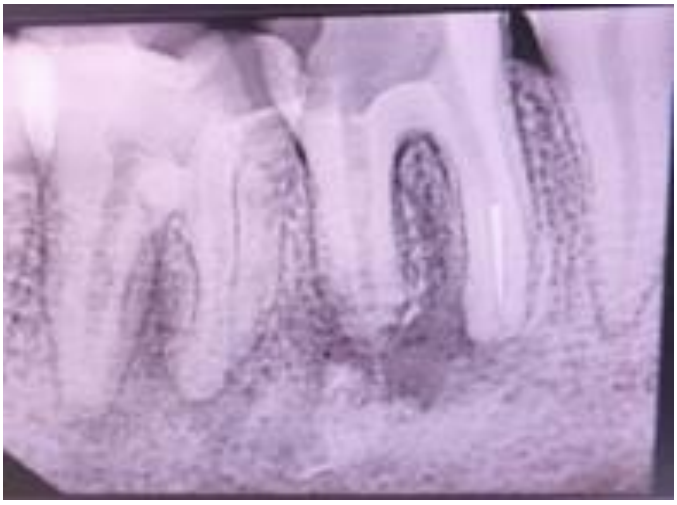

Fig b

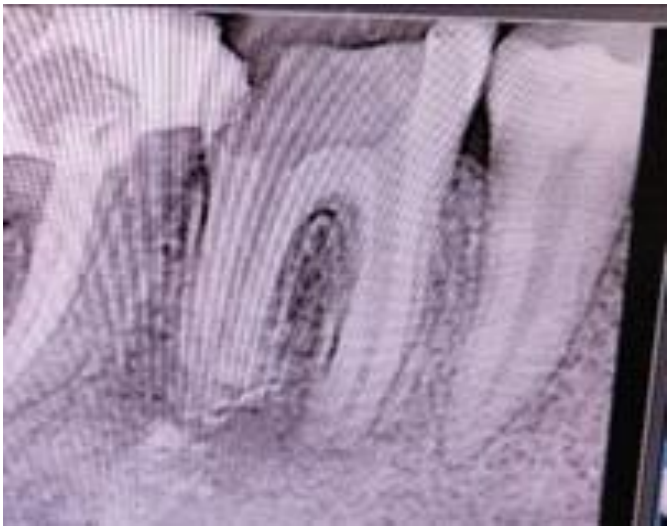

Fig c

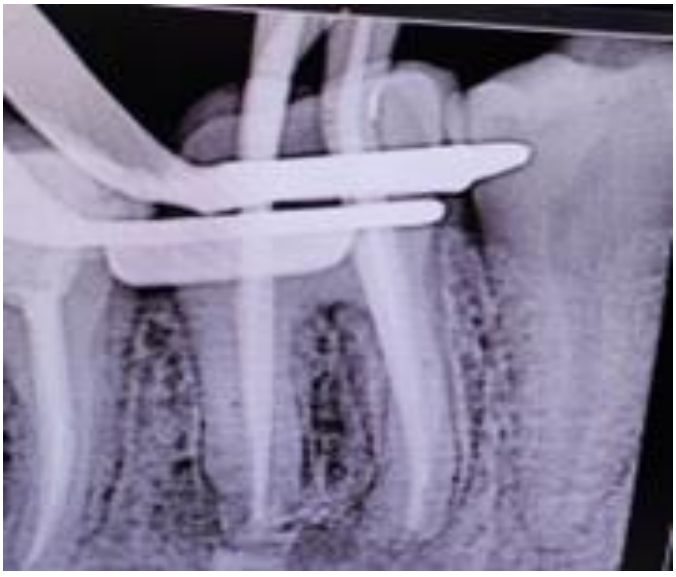

Fig d

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