

A 34-year-old male with pain and mobility of upper left lateral incisor tooth

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Presentation of Case

Dr. Sageer Ahmed (MS Resident): A 34-year-old male attended with mild pain during mastication and slight mobility on the upper left lateral incisor tooth for 2 months. He gave the history of trauma on the offending tooth 3 years ago and for this he visited to a local dentist 2 weeks ago but did not get any relief after treatment. On clinical examination, the tooth was non vital, tender to percussion with 2 degree mobility, not associated with any swelling and discharge.

Dr. Mozammal Hossain (Associate Professor): Pre-operative radiograph (Figure 1A) revealed obliteration of pulp chamber, area of rarefaction associated near the apex of upper left lateral incisor tooth, cervical radiolucency indicating the loss of periodontal structures and about 5 mm separated fragment of instrument in the coronal third of the root canal.

Dr. Ahmed: Root canal treatment combined with periodontal therapy was planned for the affected tooth. Fractured segment was located in the straight portion of coronal third of root. So, retrieval was preferred over other options. Under proper illumination with aid of operating loupes, the tip of the separated instrument was visible at the canal orifice. The basic requirement for retrieval of the separated instrument is creating a staging platform for better visibility and accessibility of separated fragment but it was not needed here due to loss of coronal tooth structure. Ultrasonic tip (E4, Woodpecker) was used for precise troughing of dentin around the file. After exposure of about 2 mm of the file tip, the Stieglitz forcep (Medesy, Italy) was used to remove it. The file tip was grasped tightly and pulled out with slight counter clockwise jerk. Photograph was taken to demonstrate the separated fragment (Figure 1B). Controlled radiovisiography was taken to confirm the retrieval (Figure 1C). The canal was negotiated with 10 K-file with aid of EDTA containing gel (Glyde, Dentsply, Switzerland). The working length was confirmed 23 mm with the help of apex locator and radiovisiography (Figure 1D). Glide path was

created by 15 K-file. The canal was prepared using rotary system (Protaper gold, Dentsply, Switzerland) up to F3. The patency of the canal was maintained using 10 K-file and irrigated with 5.25% sodium hypochlorite and 17% EDTA along with normal saline during shaping and finishing. The canal was dried with paper points and obturation was done with protaper gutta-percha i.e. F3 and sealapex (Figure 1E). The access preparation was sealed with composite restoration.

Provisional Diagnosis

Perio-endo lesion type II

Differential Diagnosis

Pulp necrosis

Dr. Ahmed: The death of the pulp (necrosis) is usually found without any painful symptom.^{1,2} The first indication of the pulp death is the discoloration of tooth.^{3,4} In some cases, the patient may have the history of severe pain which last for a few min to hours and then it ends with the sudden and complete termination of pain.^{5,6} Furthermore, as it progresses slowly and silently, the patient is usually unaware about the symptoms.⁷ There are usually no radiographic changes in the periapical tissue and the tooth mobility is absent. So, it was excluded from the diagnosis.

Chronic alveolar abscess

Dr. Chowdhury Afrina Parvin (MS Resident): The chronic alveolar abscess, if left untreated, may cause inflammatory changes of the periradicular alveolar bone.⁸ There is presence of an abscess which drains through a sinus tract.⁹⁻¹⁰ The sources are infection and the necrosis of the pulp and pre-existing acute abscess. A diffuse area of bone rarefaction could be identified by radiograph but it is non-diagnostic and therefore, the inclusion of a gutta-percha point through sinus tract could identify the involved tooth and the origin of the sinus tract is often

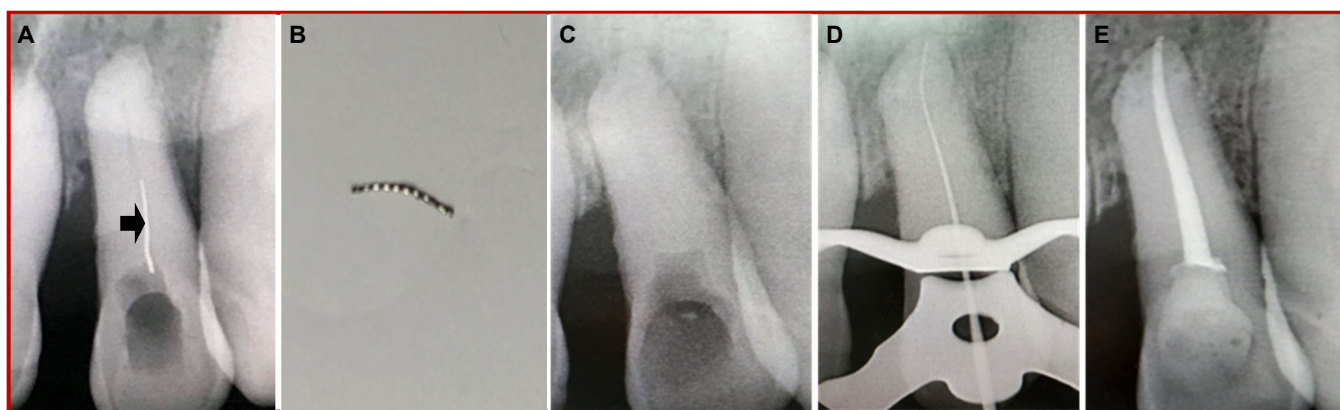


Figure 1: Pre-operative radiograph shows a broken instrument (arrow) within the canal (A); Photograph of separated instrument (B); Following retrieval of the instrument, root canal was patent (C); a K-file was inserted into the canal for working length determination (D); Canal obturation with protaper gutta-percha and sealer (E)

performed.¹¹ As there was no history of swelling, discharge or sinus tract. So, it was excluded from the diagnosis.

Chronic periodontitis

Dr. Parvin: Bacteria-induced inflammation of the periodontium is responsible for the development of chronic periodontitis with increased pocket depth.^{12, 13} Furthermore, it may be associated with gingival bleeding, recession, resorption of alveolar bone and tooth mobility in multiple teeth but the teeth remain vital. In this case, single tooth was affected in the upper anterior quadrant and the tooth was non-vital. So, it was excluded from the diagnosis.

Dr. Ahmed's Diagnosis

Tooth with intracanal instrument separation

Discussion

Management of separated instruments

Dr. Ahmed: The management includes orthograde or surgical approaches. Orthograde approaches are as follows: Attempts to remove the fragment, attempts to bypass the fragment, or cleaning/shaping and filling the root canal to the level of the fragment. In general, it would seem appropriate that the optimum management option was the removal of the fragment so that cleaning and shaping of the root canal system could be completed effectively to eliminate microorganisms. Such an approach is usually recommended in several situations that includes a) strategically important tooth, b) extension of the fragment into the coronal third of the root canal or before the root canal curvature, c) if the separation of the instrument occur in straight or slightly curved root canals.¹⁴ Furthermore, it is proposed that the separated instrument can be

removed easily when one-third of the overall length of a separated instrument can be exposed. In the present study, ultrasonic instrument has been used as an effective and safe method for the elimination of any obstruction from the root canal. A magnifying loupe ($\times 2.5$) was used for better visualization. Moreover, previous studies have indicated that an achievement of 67 to 88% or more in fragment removal using ultrasonic is possible.¹⁵⁻¹⁷ The design, length and size of the ultrasonic instrument is also favorable to use in the different parts of the root canal. If the direct application of ultrasonic energy does not loosen the separated instrument sufficiently to remove it, the fragment must be grabbed and retrieved. In this case, Stieglitz forcep was used to remove the separated instrument.

Treatment options

Govind Kumar Chaudhary (MS Resident): Many different instruments and techniques include armamentarium for the separated instrument removal. None, however, is more important than the operating microscope. The magnification and light increase its visibility and therefore, it is more effective and safe technique to be discussed. The use of a headlamp and magnifying loupes will help with the removal of many canal impediments. If the file is clinically observable in the coronal access and can be grasped with an instrument, such as a hemostat or Stieglitz Pliers, then these should be used to obtain a firm hold of the file and extract it out through the access cavity preparation. Although it is easy to remove a separated file with this technique but many files separate at a point where these forceps cannot be used. Frequently, a file will separate at a point deeper in the canal, where visibility is difficult and therefore, it is necessary to generate straight-line coronal radicular access. Straight line radicular access can also be created with the use of modified Gates-Glidden drills or modified Lightspeed nickel-titanium rotary instruments (Lightspeed Technology Inc, USA).¹⁸

Microtube technique and Wire loop technique can also be used for retrieval. The use of an end-cutting trephine bur to remove the tooth structure around the file for the removal of the separated instrument can be possible with the Endo Extractor (Brasseler, USA), the Masserann Kit (Medident International), and the Extractor System (Roydent).¹⁹

The use of braiding files technique is also effective when the fragment is situated deeply into the root canal is such a way that it is not visible and the clinician is relying on tactile sense. Moreover, it is also useful when retrieval of separated instrument cannot be achieved using other means. Canal finder system is also one of the effective methods. In another technique, EDTA has been proposed to soften the root canal wall dentin around separated instrument and then it will facilitate the placement of files for the removal of the fragment. Other chemicals such as iodine trichloride, nitric acid, hydrochloric acid, sulfuric acid, crystals of iodine can also be used because they are capable of corrosion of the metal objects and help to remove the separated instrument but they can irritate the periapical tissue and are not used now-a-days. An electrochemical-induced dissolution of metal is also suggested by Ormiga et al. (2010)²⁰ It is a simple technique to remove loose fragments from the apical third of the root canal by using softened gutta-percha (GP) points.²¹ The use of the Nd:YAG laser has also been tested for the removal of separated instrument in the laboratory study.²²

Another important factor is to preserve the integrity of the tooth. The use of bypassing a fragment located deep in the root canal or beyond the root canal curvature may be the appropriate treatment option.²³ When a separated instrument cannot be removed then bypass technique can be used for cleaning, shaping, and filling the root canal system up to the level of the fragment.²⁴ It is also effective when the separation occurs at the final stage of root canal preparation or if the fragment is located in the apical third beyond a severely curved root canal. In the case when conservative management is failed, then surgical intervention may be needed to save the tooth.

Follow-up

Patient was called for follow-up and the evaluation at interval of 3, 6 and 12 months.

Dr. Ram Udgar Yadav (MS Resident): Is there any relation of the instrument design and type with instrument separation and retrieval?

Dr. Ahmed: During the root canal treatment, there is always a risk for separation of files, reamer, Gates-Glidden or Paeso drills, lentulo spiral paste fillers, thermo mechanical gutta-percha compactors or the tips of hand instruments, such as explorers or gutta-

percha spreaders which can block the root canal. It can occur without any relation of the instrument used such as stainless steel or nickel-titanium and the technique of use such as hand or engine driven. However, the separation rates of stainless steel instruments ranged between 0.25 and 6% and the separation rate of Ni-Ti rotary instruments has been reported to range between 1.3 and 10.0%.²⁵ Ni-Ti rotary instruments are more difficult to remove when compare to stainless steel and removal of K-files is easier and more successful than Hedstrom files.^{26, 27}

Dr. Tahmida Haque: What will be the prognosis of the tooth if the instrument cannot be retrieved?

Dr. Ahmed: The presence of a separated instrument in the root canal can develop complication if the root canal has necrotic, infected pulp tissue in the apical canal space. The outcome is better if the instrument is separated at the later stage of the preparation. However, if the pre-operative pulp is vital and non infected (irreversible pulpitis, for example), and there is no apical periodontitis, the presence of the separated instrument should not affect the prognosis.

Final Diagnosis

Tooth with intracanal instrument separation

Conflict of Interest

Authors declare no conflict of interest.

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