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Retrieval of a Separated Instrument from C-Shaped Root Canal System: A Case Report

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ABSTRACT: Instrument separation is an embarrassing and common procedural error that can occur during the cleaning and shaping phase of the endodontic treatment. Complex root canal morphology can be a possible cause of the instrument separation. This case report describes the successful retrieval of a separated file fragment from the coronal one third of a root canal system with C-shaped configuration in a mandibular second molar. The retrieval was achieved by ultrasonic activation under improved magnification and action of chelating agent.

I. INTRODUCTION:

Separation of root canal instruments is a common procedural complication that can happen during root canal treatment procedures. The complex configuration of root canal systems is one of the most influencing factors, not only for the occurrence of instrument separation but also during the management of such unpleasant incidents(1). One of the most complex anatomic variations is the "C" configuration of the canal system. In C-shaped root canal configuration,the root canals are connected by a web with anatomical changes along the root. The complexity of this anatomy makes it difficult to be cleaned, shaped, and obturated properly(2).

Some iatrogenic errors may occur during cleaning and shaping, such as ledges formations and root canals perforations, which would cause failure of the endodontic treatment. Intra-canal separation of instruments are one of the most difficult complications that prevent complete cleaning of the root canals, which subsequently may cause treatmentfailure and possibly teeth loss(3). There are several other contributing factors that increase the risk of instruments separation such as, overuse of instruments, inappropriate files insertion and insufficient practitioner experience(4).

There are only few case reports which previously described instrument separation in C-shaped root canal system and its management. Kaddoura and Madarati (2020) reported the successful management of apically separated instrument in a C-shaped root canal system (3). This case report describes the successful management of a separated instrument in the coronal aspect of the C-shaped root canal system of a mandibular left second molar.

II. CASE DESCRIPTION:

A 26-year-old male patient was referred by a general dental practitioner for the completion of the root canal treatment after an incident of intra-canal instrument fracturein a lower right second molar tooth with a C-shaped root canal configuration. The dentist tried to bypass the fragment, but unfortunately, it was pushed in a horizontal direction. Immediately, the referring dentist stopped the bypassing procedure and sealed the access cavity with a temporary filling. The referring dentist referred the patient to an endodontic specialist and sent the radiograph of the case (fig. 1). The tooth was slightly symptomatic on percussion.

The case difficulty and management options, according to Madarati et al(5), were discussed with the patient, including:

1) Bypassing the fragment.
2) Non-surgical attempt of removing the fragment.
3) Intentional Replantation (surgical approach).

Bypassing the fragment was neglected due to the complexity of the case and non-surgical removal attempt with ultrasonics was planned.

After achieving anaesthesia, and analysing the preoperative radiographs, it was suggested that the portion of the distal canal coronal to the fragment needs to be slightly enlarged to visualise the fragment. This was performed using gates glidden (GG) drills number 2 and 3 (Mani) under high magnification of the dental operative microscope (Global). A straight-line access was created by preparing the mesial walls of the distal canal, which was coronal to the fragment, using Pesso Reamers #3, 4 (Mani), which made the fragment visible (fig. 2).

The extent of engagement of the fragment with the canal's walls was inspected using a DG-16 endodontic explorer (Dentsply), which revealed a

firm fragment (no mobility). K-files #10, #15 and #20 (Mani) was used as an attempt to reduce this tight engagement, which proved to be successful. 17% EDTA solution was used as the lubricant. When the fragment became slightly loose, STARTX No. 1 ultrasonic instrument (Dentsply) (fig. 3) was activated carefully around the fragment in a counter-clockwise direction to loosen it more and then remove it coronally out of the canal. After the ultrasonic activation, fractured fragment popped out of the canal (fig. 4).

A radiograph was taken to ensure the complete retrieval of fragment (fig. 5). The canal's patency was confirmed, the working length was measured (fig. 6), and cleaning and shaping were completed with Protaper rotary files (Dentsply) upto F1 assisted with K-files (Mani) upto #35 by a hybrid technique. For confirmation of successful and completed retrieval of separated instrument, CBCT images were taken (fig. 7).

Following a calcium hydroxide dressing for one-week, passive ultrasonic irrigation was performed for maximum removal of residual materials. Obturation was done by injectable thermoplastic gutta-percha (Ultrafil 3D) with AH Plus sealer (Dentsply). Temporary restoration was given with zinc polycarboxylate cement (fig. 8). The patient was referred to his general dentist to complete the restorative treatment procedures.

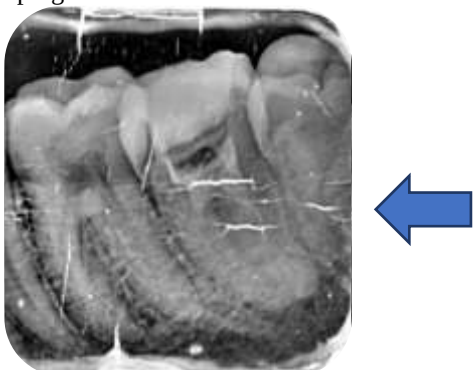

fig. 1 - Preoperative radiograph showing separated instrument

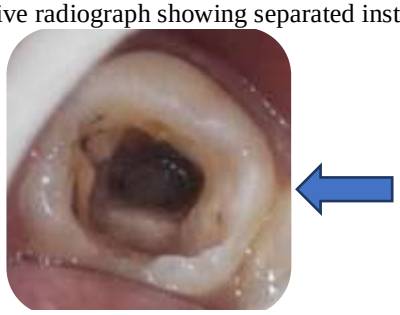

fig. 2 - Separated instrument fragment become visible

fig. 3 - Ultrasonic tip used

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Fig. 4 – Retrieved file fragment

Fig. 5 – Radiograph taken after retrieval of separated file fragment

Fig. 6 – Working length radiograph

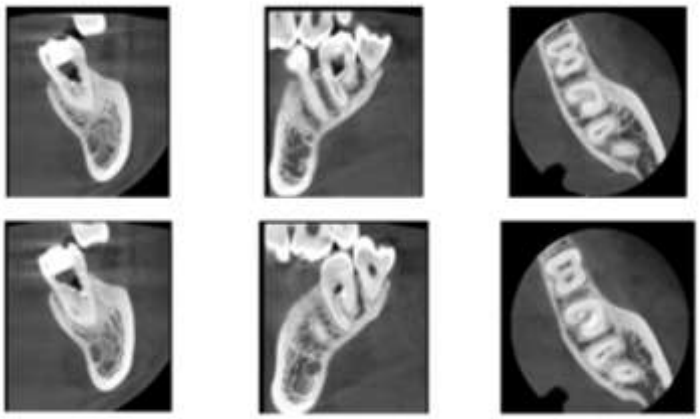

Fig. 7 – CBCT images for confirmation

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Fig. 8 – Post-operative radiograph

III. DISCUSSION:

Intracanal separation of instruments prevents access to the apex, impedes thorough cleaning and shaping of the root canal, and thus compromising the outcome of endodontic treatment and reduce the chances of successful retreatment. This type of iatrogenic error is more common among complex root canal systems (1). This can be managed either surgically or conservatively. Surgical attempt is mostly preferred when the separated fragment is apical to the curvature of root canal or if it is overextended to periapical region. If the conservative method fails or if it costs weakening of tooth structure, surgical method is attempted(6). Conservative method includes attempts of removing the fragment, bypassing it, or leaving the fragment in-situ and continuing treatment with follow-up examinations(5).

Four factors influence the decision regarding the attempt to remove separated instruments:

I. Tooth-related factors: anterior or posterior teeth and location of the fragment within the root canal, and its location in relation to the canal's curvatures.
II. Operators' factors: knowledge, a logical sequential approach, and experience.
III. Patients' factors: limited mouth opening, time constraints, anxiety, and unaffordable cost.
IV. Techniques, methods, and instruments used(7).

Anatomical factors are extremely importantas they could influence the success rate. The more coronal the fragments are within the root canal, the greater is the success rates of the removal(8). In this case report, although the root canal anatomy is a complex C-shaped configuration, the separated instrument fragment was in the coronal aspect. This made it easy to retrieve and contributed positively to the success of treatment.

Several instrument retrieval systems and techniques are available. But, in the literature, it is difficult to use thesesystems and techniques for posterior teeth, especially in case of mandibular molars due to high risk of lateral root perforations (9,10). Hence, in this case, ultrasonic activation with the help of chelating agent (17% EDTA) is used to retrieve the separated file fragment.

Sokhi et al (2014) used ultrasonic activation to retrieve a separated instrument fragments from the coronal one-third of root canal of a mandibular second molar. Theultrasonic endodontic device advocated for retrieval offractured instruments is highly effective as its use is notrestricted by the position of fragment in the root canal or toothinvolved(11).EDTA, being a calcium chelator, softensthe root canal wall dentin around the separated instrument, facilitating the placement of files and ultrasonic tips for removing the fragment(12).

The use of magnification also aided in easier and successful retrieval of separated instrument. According to Nevares et al (2012) when the separated fragment was visible with a dental microscope the success rate of retrieval was 85.5% in comparison to when the fragment was not visible wherein the success rate was 47.7%(13,14).

IV. CONCLUSION:

There is no standardized procedure for successfuland guaranteed removal of separated instrument from the root canal. Ultrasonic activation along with the use of chelating solution is highly effective as its use is notrestricted by position of fragment in the root canal or toothinvolved. Improved magnification also favoured the prognosis of treatment. This case report described the successful retrieval of a separated file fragment from the C-shaped root canal system of a mandibular second molar using

ultrasonics, chelating agent and dental operating microscope.

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