Acta Scientific Dental Sciences (ISSN: 2581-4893)

Volume 8 Issue 3 March 2024

Case Report

Retrieval of Fractured Ni-Ti Rotary Instrument from Root Canal using Ultrasonics and File Braiding Technique Under Surgical Operating Microscope

Neelam Mittal[1], Harakh Chand Baranwal[2], Harshitaa Aggarwal[3]* Sakshi Gupta[4], Aiyman Ayubi[3] and Silviya Samad[3]

[1]*Professor, Conservative Dentistry and Endodontics, Faculty of Dental Sciences, IMS, BHU), Varanasi, India*

[2]*Professor, Conservative Dentistry and Endodontics, Faculty of Dental Sciences, IMS, BHU), Varanasi, India*

[3]*Junior Resident, Conservative Dentistry and Endodontics, Faculty of Dental Sciences, IMS, BHU), Varanasi, India*

[4]*Senior Resident, Conservative Dentistry and Endodontics, Faculty of Dental Sciences, IMS, BHU), Varanasi, India*

***Corresponding Author:** Harshitaa Aggarwal, Junior Resident, Conservative Dentistry and Endodontics, Faculty of Dental Sciences, IMS, BHU), Varanasi, India.

Received: January 19, 2024

Published: February 05, 2024

Abstract

In routine endodontic therapy, a clinician may encounter many procedural errors and obstacles which may alter the course of treatment; one such error is instrument separation. A separated instrument prevents complete cleaning and shaping of the root canal and this might potentially influence the course of the treatment. Hence, every attempt must be made to retrieve the broken instrument. There are various instrument retrieval kits and chairside techniques available for this purpose. The present case report describes the successful retrieval of separated nickel-titanium rotary instrument using ultrasonics and file braiding technique under surgical operating microscope.

Keywords: Instrument Separation; Ultrasonics; File Braiding Technique; Direct Observing Microscope

Abbreviations

EDTA: Ethylene Diamine Tetraacetic Acid; IOPA: Intraoral Periapical Radiograph

Introduction

Instrumentation of root canal has advanced from the simple hand filing with stainless steel files to the use of rotary Ni-Ti instrumentation [1]. These Ni-Ti rotary files are preferred because of the higher flexibility for use in curved canals. Even with the superior qualities of Ni-Ti files compared to the stainless steel files, these may fracture inside the canal without any visible warning signs. Stainless steel instruments have been reported to have separation rates ranging from 0.25% to 6%, whereas Ni-Ti rotary instruments have separation rates between 1.3% and 10.0% [2].

While a broken instrument may not always result in the failure of root canal therapy, it hinders the complete debridment and sealing of the root canal system. This can lead to the unpredictable longevity of the root canal treatment. Thus this necessitates an attempt to recover the broken instrument.

There are various specialized instrument retrieval kits such as the Masserann Kit, IRS Kit, and Canal Finder system. Various studies have also highlighted chairside ways for recovering broken instruments, including the wire-and-loop method, file braiding technique, hypodermic needle technique, and adhesive technique [3].

The present case report describes the successful retrieval of separated Ni-Ti rotary instrument with the help of ultrasonics and file braiding technique.

Case Report

A 47-year-old female patient presented to the department of Conservative Dentistry and Endodontics with pain in the mandibular left molar. The patient gave a history of previous root canal treatment for the same tooth 2 years back.

An intraoral periapical radiograph revealed the separated instrument (approximately 11 mm length) at the junction of the coronal and middle third of the canal (Figure 1).

Figure 1: IOPA xray showing fractured instrument in mesial root of lower left mandibular molar and presence of PDL space widening.

The tooth was anaesthetised using 2% lignocaine hydrochloride with 1:1,00,000 adrenaline. Under rubber dam isolation, the access cavity was modified and the lingual shoulder was removed using Gates Glidden (GG) drill-3, -2, -1 (Dentsply, Switzerland) to ensure a straight line access to the coronal end of the fragment.

When viewed the coronal part of the separated instrument was visible inside the mesio-buccal canal and was threaded into the dentin (Figure 2).

Figure 2: Upon access opening mesio-buccal root shows presence of fractured file.

The surrounding dentin was troughed all around the fractured instrument using ultrasonically activated tip number ET25 mounted on handpiece (Eighteeth, Ultra-X) under continuous irrigation. This was done to free the coronal end of the fragment. The fractured fragment was gently bypassed using K-file ISO size 15 and with the use of 17% EDTA to the full working length (25 mm) and enlarged up to size 35. Thus space was created between the fragment and the canal wall.

As the fractured file could not be recovered using repeated 'push and pull' motions, the file braiding technique was employed wherein the fractured instrument was engaged as deep as possible with the help of two new H-files of ISO sizes 15 and 15 (Maillefer, Dentsply, USA). Braiding of these files and a short outward pull resulted in the instrument being removed from the canal (Figure 3-5). A radiograph was taken to confirm the complete removal of the broken instrument (Figure 6).

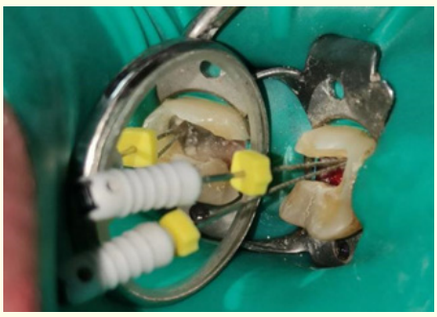

Figure 3: File braiding to engage the fractured instrument using two 15 H-files.

Figure 4: Intraoral picture fillowing the fractured file removal.

Figure 5: Fractured file braided with the H- files.

Figure 6: IOPA taken to verify the complete removal of the fractured instrument.

Following pre- endodontic build-up of the the lost crown structure (Figure 7), cleaning and shaping was performed using rotary Protaper Gold files system and the canals were enlarged up to F2 with irrigants 2.5% sodium hypochlorite, 17% EDTA and 2% Chlorhexidine during instrumentation (Figure 8). The canal was dried with absorbent paper points and obturation was done using Gutta-percha and bioceramic sealer (Dentsply Ballaigues, Switzerland) (Figure 9). The access cavity was restored with resin composite Filtek Z250 (3M Dental Products, USA). The patient was asymptomatic during the 4-week follow-up period (Figure 10).

Figure 7: Intraoral picture following pre- endo crown build- up and biomechanical preparation of root canals.

Figure 8: Working length IOPA.

Figure 9: Master cone IOPA.

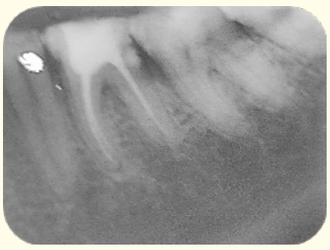

Figure 10: IOPA following obturation and post- endodontic restoration.

Discussion

During root canal treatment, a dentist may encounter various procedural mishaps. A fractured file inside the canal can be troublesome in achieving a good long-term prognosis following the root canal treatment.

A Ni-Ti rotary file may fracture inside the root canal due to cyclic or torsional fatigue [5]. A variety of strategies such as heat treatment, ion implantation, electropolishing, twisting of files, altering the metallurgy [6], and newer design features [7] are being employed during the manufacturing process to improve the fracture resistance.

The fracture of Ni-Ti rotary instruments has been linked to a number of causes, including excessive cyclic fatigue, torsional failure or a combination of both. The stainless steel files fracture mainly due to the excessive torque during usage.

Various factors predispose to file fracture like the manufacturing process, canal curvature, rotating speed, instrument design and the lack of a glide path. In present case, file separation may have resulted from restricted access, incorrect file angulation during usage, canal anatomy, and excessive file utilisation.

Retrieval of fractured file is usually difficult and in some cases can be impossible. The success rate has been reported from 55 to 79% [8]. Some previous studies have shown no adverse effects of the broken fragment retained in the root canal while others have reported the prognostic factors like periapical radiolucency, apical extent of the fractured instrument that ultimately decide the fate of the treatment.

Intracanal instrument separation can be effectively managed by either bypassing it or retrieving [3]. However, retrieval was attempted in the present case; as the file separated at seemingly initial stages, the tooth was strategically important and accessibility that was enhanced with surgical opeerating microscpe.

Diameter, length and position of the fragment within the root canal and the canal anatomy influence the nonsurgical removal of a broken instrument. In this case report, instrument was fractured in a straight mesio-buccal canal, from the straight canals broken fragment can be typically removed.

There are various specialized instrument-retrieval kits such as the Masserann Kit, Cancellier Kit, IRS Kit, Canal Finder, Endo rescue, and Mini forceps that works by freeing the fragment from surrounding dentin and use of microtube to grasp the fragment [3].

However, these devices are not readily available, very expensive and usually involve removal of a considerable amount of dentin which could weaken the roots. Few authors suggest the use of specialized ultrasonic tips under DOM to overcome the problem of excessive removal of dentin. Operating under high power magnification enables precise use of ultrasonic, avoiding unnecessary dentin removal thereby increasing the success rate by 67%–95% [8].

In this particular case, the fractured instrument was bypassed and ultrasonic troughing was performed on the dentin surrounding the fragment using the ET25 tip. This titanium- niobium endodontic tip is used in retreatment and for retrieval of broken instruments from the canal. It has a taper of 3% and a length of 20mm.

Then the file braiding technique was employed in the present case with two new 15K H-files that were braided and a short outward stroke that retrieved the fragment.

Recently, Wohlgemuth., *et al*. studied the effectiveness of novel gentle wave irrigation system that works by multisonic ultracleaning principle in retrieval of fractured instrument [10].

It is prudent to prevent separation of instruments as attempting its retrieval is time-consuming, involves potential complications, and increases the patient's anxiety level. Instrument separation can be avoided by following proper straight line access, using Ni-Ti rotary files at settings suggested by the manufacturer, single usage of Ni-Ti rotary files and having adequate glide path prior to Ni-Ti instrumentation.

Conclusion

The Ni-Ti rotary file was successfully retrieved in the mandibular first molar using ultrasonic tips and canal braiding technique.

Conflict of Interest

"The authors deny any conflicts of interest".

Bibliography

1. Bergenholtz G., *et al*. "Textbook of Endodontology". 2003 1st Blackwell Munksgaard Oxford (2003).

2. Wu J., *et al*. "Instrument separation analysis of multi-used ProTaper Universal rotary system during root canal therapy". *Journal of Endodontics* 37 (2011): 758-763.

3. Madarati AA., *et al*. "Management of Intracanal Separated Instruments". *Journal of Endodontics* 39 (2013): 569-581.

4. Bruce L Chenail and Paul E Teplitsky. "Orthograde Ultrasonic Retrieval of Root Canal obstruction". *Journal of Endodontics* 13 (1986): 186-190.

5. Peters OA. "Current challenges and concepts in the preparation of root canal systems: A review". *Journal of Endodontics* 30 (2004): 559-567.

6. Gutmann JL and Gao Y. "Alterations in the inherent metallic and surface properties of nickel-titanium root canal instruments to enhance performance, durability and safety: A focused review". *International Endodontic Journal* 45 (2012): 113-128.

7. Ha JH., *et al*. "Screwing in forces during instrumentation by various file systems". *Restorative Dentistry and Endodontics* 41 (2016): 304-309.

8. Al-Zahrani MS and Al-Nazhan S. "Retrieval of separated instruments using a combined method with a modified vista dental tip". *Saudi Endodontic Journal* 2 (2012): 41-45.