

Broken File Retrieval: Challenge in Endodontics

P. Karunakar¹ M.S Ranga Reddy² Basa Srinivas Karteek^{3*} D. Venkata Satishwar Reddy⁴

¹Professor and Head, Department of Conservative Dentistry and Endodontics, Panineeya, Institute of Dental sciences & Research Centre, Hyderabad, India.

²Professor, Department of Conservative Dentistry and Endodontics, Panineeya, Institute of Dental sciences & Research Centre, Hyderabad, India.

³Senior Lecturer, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental sciences & Research Centre, Hyderabad, India.

⁴PG Student, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental sciences & Research Centre, Hyderabad, India.

ABSTRACT

Background: In a day to day practice dentists are facing many problems. One of the common problems is separation of an instrument. The separation of an endodontic instrument instantly transforms a case, from whatever level of difficulty it was preoperatively, to a new level of severity. The aim of the article is to present a case that used RVG and CBCT to locate and successfully remove a fractured endodontic instrument usage of ultrasonics around the binded instrument and thereby loosening it and removing it with the help of a lock in tweezer..

Keywords: RVG, CBCT, Ultrasonics.

INTRODUCTION

In a day to day practice dentists are facing many problems. One of the common problems is separation of an instrument.¹ The separation of an endodontic instrument instantly transforms a case, from whatever level of difficulty it was preoperatively, to a new level of severity.² A separated instrument can create an obstruction in the root canal which can hinder the cleaning and shaping procedures.³ Biomechanical preparation of the entire root canal system is one of the most important procedures in endodontic treatment. Separation of instruments while preparing root canals presents a compromised situation in which a biologically inert segment is left behind with potential contamination that has the ability to affect the healing process.⁵

The separated instrument could be endodontic files, Gates Glidden burs, and spreaders. Fracture often results from incorrect use or overuse of an endodontic instrument.⁶ There are various reasons for instrument separation inside the canal, such as over-instrumentation, improper filing techniques,

increased speed with rotary instrument, loss of tactile sensation, anatomical variations like curved canals, and accessory canals. When instrument separation

occurs, the clinician has the choice of (1) leaving the instrument in the canal, (2) bypassing and obturating the canal, or (3) retrieving the file segment either surgically or non surgically. Recently, the advent of rotary NiTi instruments has led to a perceived high risk of instrument separation.² Furthermore, the separation of rotary NiTi instruments may occur without warning;⁷ the mean clinical separation frequency of rotary NiTi instruments is approximately 1.0% with a range of 0.4 to 3.7%.⁸⁻¹¹ The reasons for separation of rotary NiTi instruments are complex and multifactorial;^{9,12,13} Separated rotary NiTi instruments have been classified into those that fail as a result of cyclic flexural fatigue or torsional failure¹⁴ or a combination of both.¹⁵ There are factors predisposing to separation such as instrument design, manufacturing process, dynamics of instrument use, canal configuration, preparation technique, cleaning and sterilization

Received: Mar. 4, 2019; Accepted: Apr. 2, 2019

*Correspondence Dr. Basa Srinivas Karteek.

Department of Conservative Dentistry and Endodontics, Panineeya, Institute of Dental sciences & Research Centre, Hyderabad, India.

Email: drkarthik.basa@gmail.com

process, and number of uses.¹⁶ Some studies report no effect on the healing of root-filled teeth with a retained instrument fragment^{17,18} while others reported a lower rate of healing when a separated instrument was present.¹⁹

A retained fractured instrument *per se* generally did not adversely affect endodontic case prognosis.¹⁶ The presence of a preoperative periapical radiolucency rather than the fractured instrument is clinically more significant and demonstrates the major negative influence of established and advanced root canal infections.¹⁶⁻¹⁹ Additionally, two potentially important prognostic variables, inadequate size and apical extent of the fractured instrument, could have an impact on prognosis.

The success of file retrieval depends on the canal anatomy, metallurgy of the broken file segment, location of the fragment inside the canal, the plane in which the canal curves, the length of the separated fragment, and the diameter of the canal itself.⁴ When the fractured segment lies apical to canal curvature, overzealous removal of tooth structure is required to gain access to the separated segment which in turn increases the likelihood of root fracture. In infected cases, the stage at which instrument separation occurs is crucial as root canal disinfection is jeopardized.³ The fractured segment, always accompanied with bacteria and dentine debris, is a foreign object and might cause inflammation.^{24,25} Moreover, patients often regard the fractured segment as “a broken needle” and suffer psychologically. Therefore, an attempt to remove the segment from such cases with a surgical approach is often necessary. Before surgery, the precise position and size of the fractured instrument should be understood as well as its relation to the root apex and surrounding anatomic structures.²⁶ This article uses RVG and CBCT to locate and successfully remove a fractured endodontic instrument by usage of ultrasonic around the instrument and removing the fractured file with a lock in tweezer.

CASE REPORT

Case 1:

A 35-year-old male patient reported in the postgraduate clinic of the Department of Conservative Dentistry and Endodontics of

Panineeya Institute of Dental sciences & Research centre with the chief complaint of pain with relation to lower left back tooth region. The patient gave a history of root canal treatment in the lower second molar tooth at a private clinic 6 months back. He was experiencing pain in the same teeth since 3 to 4 months. Clinical examination revealed that there was no associated swelling in relation to the involved teeth but the tooth was tender on percussion. The surrounding gingival tissue appeared inflamed, but the pocked depths were within the normal limits. On taking of RVG (fig 1) it was noted that there was a separated instrument confining the entire length of the mesial canal. Patient was referred for Cone beam computed tomography image of the same to confirm the exact location and position of the fractured file (Fig 2). The results showed the separated instrument within the mesio-lingual canal.

The Clinical procedure was started. After rinsing the patient's mouth with 0.2% chlorhexidine solution, local anaesthesia was administered and isolation was done with rubber dam. Access cavity was modified using a safe-end fissure bur (Dentsply) to obtain a straight-line access to the canals. Then, using a modified Gates Glidden drill (size 1, Dentsply), a staging platform was created. This was done to expose the file and the surrounding dentin to allow thinner ultrasonic tips to trough deeper around the file. After staging, ET25 tip of Endo Success™ (Fig 3)

Retreatment kit was attached to the ultrasonic device (Fig 4) and was activated first at the inner dentinal wall of the distal canal to create a tiny pocket approximately 1.0 mm deep from the severed surface of the file fragment. Once this narrow space was obtained, a shallow groove was cut along the outer dentinal wall such that there was no obstruction to keep the fragment from being pulled coronally. Ultrasonic vibration was applied to the separated file in the space created between the fragment and the inner wall of the canal, and moved in “push and pull” motions until the separated instrument binding of the coronal portion of the separated file was loosened.

As the separated file could be easily seen in the canal orifice and due to toughing using ultrasonics,

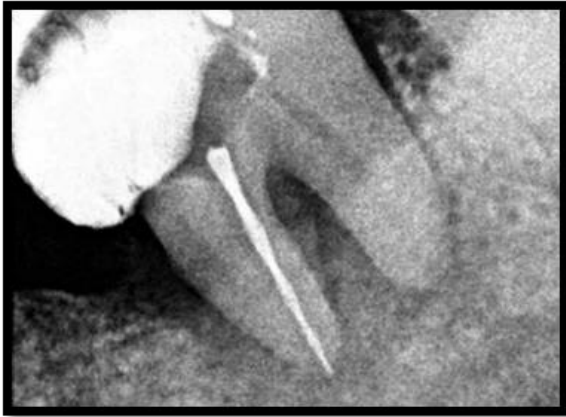


Fig 1: Pre Operative RVG Image Showing fractured rotary file.

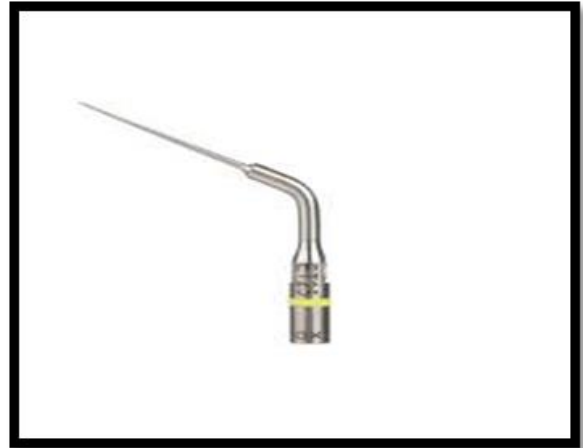


Fig 4: ET 25 ultrasonic tip.



Fig 2: Pre Operative CBCT Image Showing fractured rotary file.

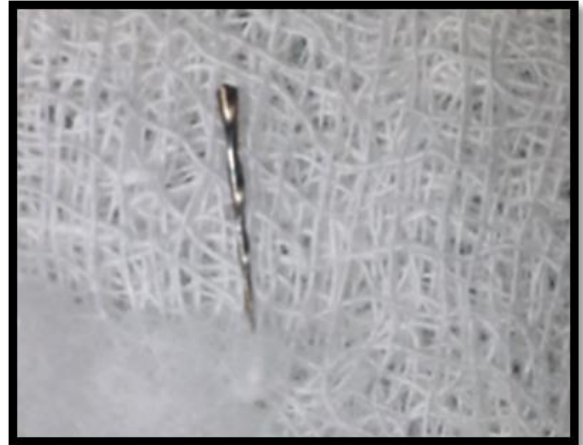


Fig 5: Retrieved fractured rotary file.



Fig 3: Ultrasonic machine.

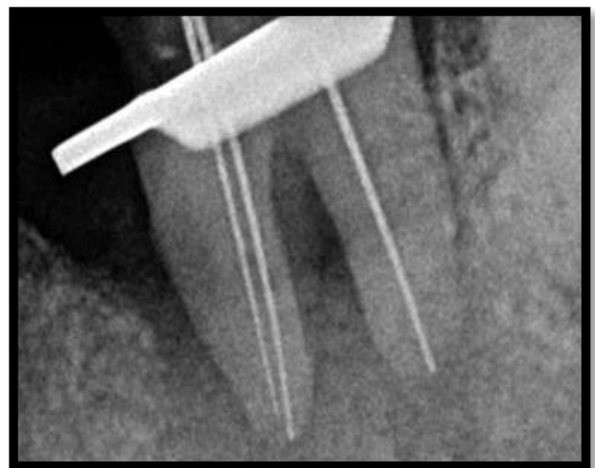


Fig 6: Working Length RVG.

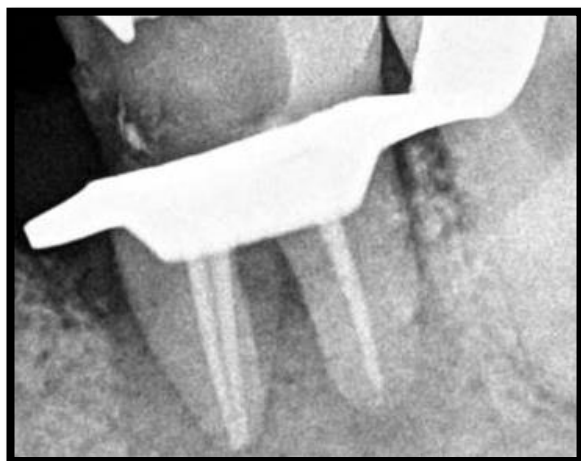


Fig 7: Master Cone RVG.

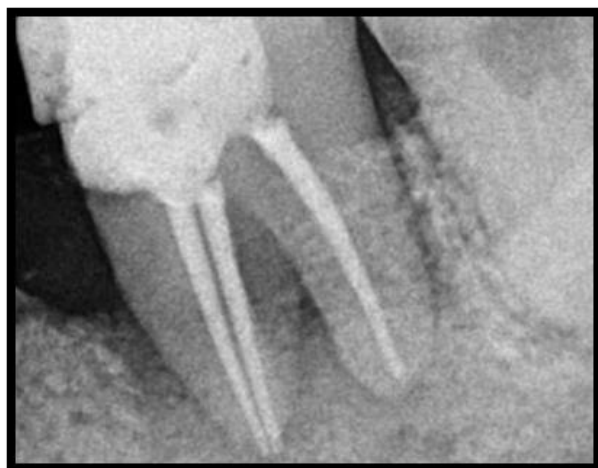


Fig 8: Post Endo RVG.

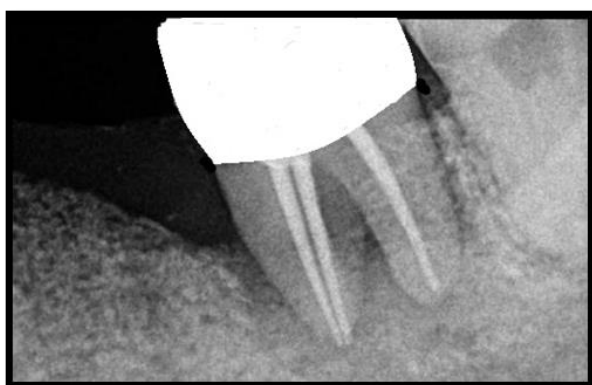


Fig 9 : 6 Month follow up image

there was sufficient space to easily pull out the file using the lock in tweezers. A radiograph was taken to confirm retrieval of the file fragment.

After instrument retrieval, working length (Fig 6) was determined using an apex locator (woodpecker minipex) and radiographs. The root canals were cleaned and shaped in a crown-down manner using rotary NiTi files (ProTaper, Dentsply). Next, 2.5% sodium hypochlorite and 2% chlorohexidine were used for irrigating the root canals and calcium hydroxide (Apexcal) as an intracanal medicament was placed. In the second visit, obturation was carried out by single cone technique using gutta-percha points(Fig 7) (ProTaper, Dentsply) and AH-Plus sealer (Dentsply,). The access cavity was restored with composite restoration, In the subsequent appointment crown preparation was done for Metal-ceramic crown(Fig 8) and the same was fixed. Patient recalled for follow up after 6 months and it was noted that the tooth was normal in function(Fig 9).

Case 2:

A 47-year-old male patient reported in the postgraduate clinic of the Department of Conservative Dentistry and Endodontics of Panineeeya Institute of Dental sciences & Research centre with a chief complaint of incomplete root canal treatment in lower left tooth. Patient gave history of root canal treatment at a local dentist, initiated 2 weeks prior. Patient was asymptomatic. Medical history was non-contributory. Clinical examination revealed incomplete access preparation and caries excavation in relation to mandibular right first molar (36). The tooth was nontender on percussion and palpation. Periodontal probing depths were normal. Tooth was nonvital. RVG image(Fig 1) was taken which revealed separated instrument fragment, extending approximately 2 mm below the canal orifice, to the end of the middle third of the mesial canal.

In the first appointment, Patient's informed consent was obtained. Under local anaesthesia and rubber dam isolation, caries were removed and access cavity was modified and canal orifices were located using DG16 explorer & a straight line access was created by Gates Glidden drills. Obstruction to canal was felt when k file No. 15 was introduced into the canal but with the help of magnifying loupes exact location of the coronal end of the separated instrument could be appreciated in the canal. After that No. 10 K file was inserted passively and

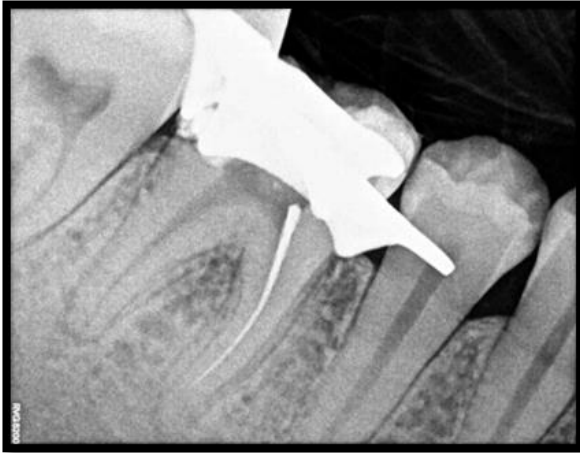


Fig 1: Pre Operative RVG Image Showing fractured rotary file.



Fig 4: Retrieved fractured rotary file.



Fig 2: ET 25 ultrasonic tip.

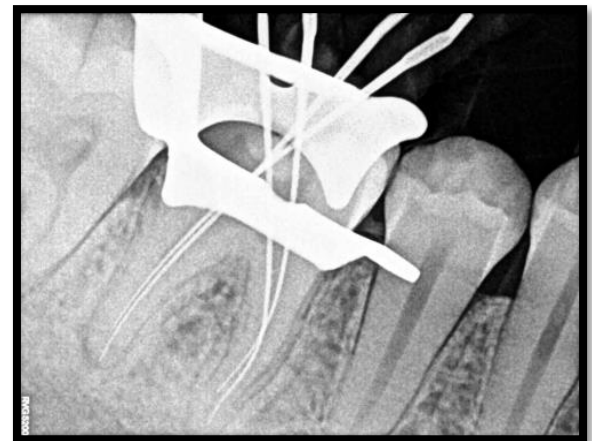


Fig 5: Working Length RVG.



Fig 3: Ultrasonic Machine.

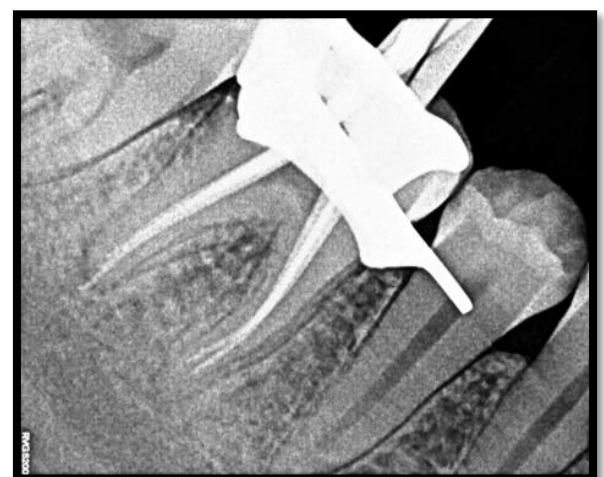


Fig 6: Master Cone RVG.



Fig 7: 6 Month follow up image

advanced only 1mm at a time with copious amount of irrigant (5.25% NaOCL) and after a given insertion if K file comes out of the canal bent or deformed it was discarded. Ultrasonic tips (Pro Ultra ENDO Tips, DENTSPLY Tulsa Dental, Tulsa, Oklahoma)(Fig 2) were used in an Ultrasonic device (Coltene, Whaledent) (Fig 3) around the fragment to expose it, and then ultrasonic activation with ultrasonic tips were applied to remove the fragment that makes the fragment loosen now the fractured fragment was removed using H file which was approximately 3mm in length. The patency of the canal was checked using magnifying loupes.

Multiple radiographs in different angulations were taken; working length was determined using electronic apex locator. Cleaning and shaping were done using WaveOne Gold. Irrigation was performed with 3% sodium hypochlorite solution. Calcium hydroxide paste was used as an intra-canal medicament. Magnifying loupes and ultrasonic's which were used and Clinical image of the retrieved broken instrument. In second appointment, Calcium hydroxide paste was removed using normal saline & Canals were then irrigated with 17% aqueous EDTA solution as a final flush. Root canals were obturated (Fig 5&6) with gutta-percha and AH Plus sealer using warm vertical compaction technique The tooth was subsequently restored. Follow up was done for 6 months and the patient was found to be clinically asymptomatic (Fig 7).

DISCUSSIONS

Fracture of an endodontic instrument during root canal treatment causes inability to further clean and shape the root canal system can compromise the outcome of the treatment. In such cases, it is said that the prognosis depends on the condition of the root canal (vital or non-vital), canal anatomy, type of pulpal pathology, periapical status, degree of cleaning and shaping at the time of separation, the level of file separation in the canal and type of fractured instrument. The prognosis of these teeth is generally lower than that of a tooth with normal endodontic treatment.²⁷

Orthograde and surgical approaches are the two methods recommended for managing cases with broken instruments.²⁹ Bypassing the instrument, removing the instrument or preparation of the canal and obturation to the level of the fractured instrument are phases of an orthograde approach. In our case as the patient was referred by some other dentist, we did not know the actual extent of canal disinfection when the instrument broke, and thus, bypassing or retrieving the separated instrument deemed necessary. As the separated instrument extended beyond the apex, bypassing the instrument or obturation to the level of the fractured instrument would not serve the purpose. Considering the non-surgical endodontics being the more conservative approach, the retrieval of instrument was attempted.²⁸

Diameter, length and position of the fragment within the root canal influence the nonsurgical removal of a broken instrument.²⁹ Also, the thickness of root dentin, the depth of external concavities and the root canal anatomy influence the removal of the broken fragment. Instruments that lie in the straight portions of the canal can be typically removed.³⁰ In this case report, instrument was fractured in the distal canal, which was a straight canal with the least curvature.

Material type of the fractured instrument is also an important factor to be considered during its removal. The Stainless Steel(SS) files do not fracture upon removal with ultrasonics, while NiTi instruments may undergo further fracture due to heat build-up when ultrasonic devices are used for their removal.

Tu et al.³¹ reported a case in which, a separated Ni-Ti instrument was retrieved using several

ultrasonic tips under a dental operating microscope from the distolingual root canal of a mandibular first molar. The instrument was separated at the middle third of the canal whereas in our case the file broke beginning from the coronal third & not extending beyond the apex, which made its retrieval easier. Several methods and instrument retrieval systems have been proposed for retrieval of broken instruments from the root canals. However, none of them can guarantee 100% success or can be considered the gold standard for instrument retrieval. Due to various advantages of ultrasonics in instrument retrieval such as minimal dentin damage and compatible tip designs, which can reach the deeper confines of the canal, ultrasonic retrieval was attempted in our case.

However, one must consider that with the advent of rotary NiTi files, the occurrence of broken instruments has increased, especially in the hands of inexperienced clinicians. Proper training of new techniques and adherence to the established principles and guidelines of clinical usage can reduce the incidence of NiTi instrument fracture.

CONCLUSION

The ultrasonic technique was successful in removing the rotary NiTi file fractured in the mandibular molar tooth.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Dr. AneriDoshi, Dr.ChandniDoshi, Dr.Minal Desai, Dr. Hitesh Doshi, 2017. "Retrieval of Fractured Instrument From Root Canal: A Case Report", *International Journal of Development Research*, 7, (06), 13388-13391.
2. Priyanka Chopra , Anjali Gupta , Ram Tiwari ,2016 Neo adjunct technique to retrieve broken instrument- A case Report *Journal Of Applied Dental and Medical Sciences* 2(1);2016
3. Steven J. Cohen, Cert. Endo, Gary D. Glassman and Richard Mounce. Rips, Strips and Broken Tips: Handling the Endodontic Mishap PART I: THE SEPARATED INSTRUMENT. *Oral health* May 2005.
4. Dr. Clifford J. Ruddle. Broken Instrument Removal: The Endodontic Challenge . *Dentistry Today* July 2002.
5. Vyavahare N, Kulkarni M, Desai N. Retrieval of a separated nickel-titanium instrument and a stainless steel H-file using a novel tube, loop and file technique. *J IntClin Dent Res Organ* 2018;10:88-92.
6. Gambarini G. Cyclic fatigue of ProFile rotary instruments after prolonged clinical use. *IntEndod J* 2001;34:386-9.
7. Parashos P, Messer HH. Questionnaire survey on the use of rotary nickel-titanium endodontic instruments by Australian dentists. *IntEndod J* 2004;37:249-59.
8. Pruett JP, Clement DJ, Carnes DL, Jr. Cyclic fatigue testing of nickel-titanium endodontic instruments. *J Endod* 1997;23:77-85.
9. Al-Fouzan KS. Incidence of rotary ProFile instrument fracture and the potential for bypassing *in vivo*. *IntEndod J* 2003;36:864-7.
10. Pettiette MT, Conner D, Trope M. Procedural errors with the use of nickel-titanium rotary instruments in undergraduate endodontics. *J Endod* 2002;28:259.
11. Iqbal MK, Kohli MR, Kim JS. A retrospective clinical study of incidence of root canal instrument separation in an endodontic graduate program: A PennEndo Database Study. *J Endod* 2006;32:1048-52.
12. Mandel E, Adib-Yazdi M, Benhamou LM, Lachkar T, Mesgouez C, Sobel M. Rotary Ni-Ti profile systems for preparing curved canals in resin blocks: Influence of operator on instrument breakage. *IntEndod J* 1999;32:436-43.
13. Yared GM, Dagher FE, Machtou P, Kulkarni GK. Influence of rotational speed, torque and operator proficiency on failure of Greater Taper files. *IntEndod J* 2002;35:7-12.

14. Sattapan B, Nervo GJ, Palamara JE, Messer HH. Defects in rotary nickel-titanium files after clinical use. *J Endod* 2000;26:161-5.
15. Parashos P, Messer HH. Rotary NiTi instrument fracture and its consequences. *J Endod* 2006;32:1031-43.
16. Crump MC, Natkin E. Relationship of broken root canal instruments to endodontic case prognosis: A clinical investigation. *J Am Dent Assoc* 1970;80:1341-7.
17. Spili P, Parashos P, Messer HH. The impact of instrument fracture on outcome of endodontic treatment. *J Endod* 2005;31:845-50.
18. Strindberg LZ. The dependence of the results of pulp therapy on certain factors. An analytic study based on radiographic and clinical follow-up examinations. *Acta Odontol Scand* 1956;14:1-175.
19. Hülsmann M. Removal of silver cones and fractured instruments using the Canal Finder System. *J Endod* 1990;16:596-600.
20. Hülsmann M. Methods for removing metal obstructions from the root canal. *Endod Dent Traumatol* 1993;9:223-37.
21. Ruddle CJ. Nonsurgical retreatment. *J Endod* 2004;30:827-45.
22. Gaffney JL, Lehman JW, Miles MJ. Expanded use of the ultrasonic scaler. *J Endod* 1981;7:228-9.
23. Ruddle CJ. Micro-endodontic nonsurgical retreatment. *Dent Clin North Am* 1997;41:429-54.
24. Kaufman A, Neuman H. Iatrogenic damages caused by dental procedures. Foreign bodies in the oral cavity. *Quintessence Int Dent Dig* 1983;14(3):361-6.
25. Lin LM, Rosenberg PA, Lin J. Do procedural errors cause endodontic treatment failure? *J Am Dent Assoc* 2005;136(2):187-93.
26. Wang H, Ni L, Yu C, Shi L, Qin R. Utilizing spiral computerized tomography during the removal of a fractured endodontic instrument lying beyond the apical foramen. *Int Endod J* 2010;43(12):1143-51.
27. Agrawal V, Kapoor S, Patel M. Ultrasonic Technique to Retrieve a Rotary Nickel-Titanium File Broken Beyond the Apex and a Stainless Steel File from the Root Canal of a Mandibular Molar: A Case Report. *J Dent (Tehran)* 2015;12(7):532-536.
28. Vivekananda Pai AR, Mir S, Jain R. Retrieval of a metallic obstruction from the root canal of a premolar using Masseran technique. *Contemp Clin Dent* 2013. October; 4 (4): 543- 6.
29. Alomairy KH. Evaluating two techniques on removal of fractured rotary nickel-titanium endodontic instruments from root canals: an in vitro study. *J Endod* 2009. April; 35 (4): 559- 62.
30. Souter NJ, Messer HH. Complications associated with fractured file removal using an ultrasonic technique. *J Endod* 2005. June; 31 (6): 450- 2.
31. Tu MG, Chen SY, Hsue SS, Huang HL, Tsai CC. Removal of a separated nickel-titanium instrument from a three-rooted mandibular first molar. *Mid Taiwan J Med* 2009; 14: 27- 33.