

**Management of Instrument separation - A review and a case report of conservative management of a separated instrument**

<sup>1</sup>Dr. Aswathi P, Post Graduate Students, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

<sup>2</sup>Dr. Sabir Muliari, Professor and HOD, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

<sup>3</sup>Dr. Ranjith K, Reader, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

<sup>4</sup>Dr. Harsha Haridas, Post Graduate Students, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

<sup>5</sup>Dr. Shilna Kunju Mohamed, Post Graduate Students, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

**Corresponding Author:** Dr. Aswathi P, Post Graduate Students, Dept. of conservative dentistry and endodontics, MES Dental College, Perinthalmanna

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**Conflicts of Interest:** Nil

**Abstract**

Separation of an endodontic instrument in the root canal is a common mishap that may occur during endodontic treatment. It may negatively impact the outcome of the treatment as it hinders the cleaning and shaping` of the root canal system. Removal of the separated instrument is often advised but factors like poor access and visibility and the amount of dentin removed during the process makes bypassing the separated instrument as a very effective and conservative strategy. This article gives a brief review on managing separated instruments and a

case report of conservative management of separated instrument by bypassing the separated fragment.

**Keywords:** Instrument Separation, Bypassing, Root Canal Treatment, Obturation

**Introduction**

One of the most troublesome complications in endodontic therapy is having a separated instrument (SI) within the root canal space. Many clinicians associate “broken instruments” with separated files, but the term could also apply to a sectioned silver point, a segment of lentulospiral, gates Glidden drill, lateral or finger spreaders, and paste fillers and they can be made from

nickel-titanium, stainless steel or carbon steel (1). Regardless of which type of instruments the clinician uses, whether stainless steel or nickel – titanium, and how they are used, by hand or engine driven, the potential for separation exists. The advent of nickel-titanium (NiTi) alloys has not resulted in a lower incidence of instrument separation. Whereas separation rates of stainless steel (SS) instruments have been reported to range between 0.25% and 6% (2), the separation rate of NiTi rotary instruments has been reported to range between 1.3% and 10.0%. Even in experienced hands, this problem can still occur and frustrate both practitioners and patients (3). The clinical decision should be based on a thorough knowledge of the success rates of each treatment option, balanced against potential risks of removal or file retention

**Factors predispose to instrument separation (4)**

- 1) Anatomic complexities (eg. severely curved canals)
- 2) Instrumentation technique (those that involve counter-clockwise rotation like the balanced force technique.
- 3) File design (Certain files like H files are more prone to fracture)
- 4) Manufacturing defects- sometimes defects like cracks, metal flash, roll overs etc. can predispose to file fracture.
- 5) Instruments can also separate due to either abuse or overuse.

**How to reduce the incidence of instrument separation**

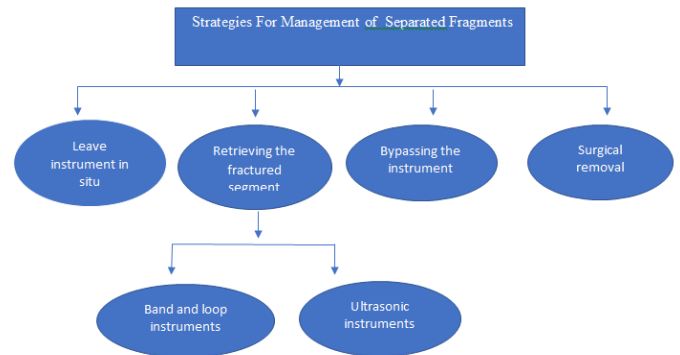
- Avoid too much stress on NiTi rotary instruments during its usage;
- Follow instructions of use for each NiTi rotary system;
- Evaluate the root canal curvature carefully, as the probability of separation increases in cases with a severe curvature;
- Prepare an adequate access cavity;

- Enlarge canal orifices and prepare a glide path before using NiTi rotary instruments;
- Always use NiTi rotary instruments with a lubricant and copious irrigation;
- Use NiTi rotary instrument with a gentle pecking or pumping motion.

**Instrument separation and prognosis (5)**

	Success rate	Influence of fractured files on outcome of endodontic treatment
Strindberg	73%	Reduction of 19%
Engström et al	67%	No effect
Engström and Lundberg	100%	No effect
Grossman	77%	Reduction in the success rate if <u>periapical lesion</u>
Crump and Natkin	91%	No effect
Fox et al	93%	Reduction in the success rate if <u>periapical lesion</u>
Kerekes and Tronstad	82%	Reduction in the success rate on tooth <u>necrosed</u>
Molyvdas et al	87%	Reduction in the success rate if <u>periapical lesion</u>

Conflicting reports success rate varies from 73-100%, fractured instrument alone can't be the reason, so during decision making weigh advantages vs disadvantages. Currently available strategies to manage separated instruments include



**1. Leave Fractured Instrument in Situ**

Separated fragment may be left in the canal, and that the canal coronal to the object should be treated according to standard endodontic procedures (6,7) This approach can be considered if the fractured segment binds snugly in

apical third only. Thermo plasticized obturation techniques were suggested in these cases.

## **2. Retrieving the separated fragment and treating the canal**

Removal of the separated instrument should always be attempted; the fragment only being retained when nonsurgical removal has been unsuccessful (8). The rationale is that unless the obstruction in the canal is removed- allowing complete chemo-mechanical disinfection of the root canal system – outcome will be significantly reduced. Furthermore, it has been reported that, endodontic treatment which is complicated by fractured instrument- demonstrated reduced healing (9). Successful retrieval of fractured instrument depends on tooth factor, equipment and instrument factor, clinician factor and patient factor.

## **3. Bypassing the separated fragment and treating the canal**

Some authors suggest that it is more conservative to bypass the fractured instrument, particularly in case where access to the fragment is restricted (apical one-third of canal or beyond the canal curvature) and its removal may lead to excessive removal of dentine with associated sequelae (10,11). Interestingly, it has been reported that if the file is bypassed, the retained fragment does not compromise obturation quality (12). Object should be bypassed and that the canal should be treated according to standard endodontic procedures and the separated fragment should be incorporated into the root filling material. In these cases, a good quality of obturation is mandatory so that the obturating material or sealer flows and seals the spaces between the flutes of separated file and canal wall. (13)

“Bypassing technique” based on the fact that none of the root canals are perfectly round, and a small gap exists between the root canal wall and the fractured fragment,

which allows a smaller file to bypass the separated fragment. This is an easy technique to master, and works out successfully majority of times, especially when the instrument is bound in coronal and middle thirds of canal. One main advantage of this technique is it does not demand direct visibility to the fragment. This method does not demand magnification aids strictly, as it is more dependent on tactile sensation of dentist, allowing its practical feasibility among general dentists; especially in developing countries like India where usage of modern endodontic equipment like surgical microscopes, ultrasonic etc is not common in their daily practice (14)

## **Case Report**

A 23-year-old women was referred to the Department of conservative dentistry and endodontics with a complaint of pain in the right upper back region for the last one month. On examination, a deep carious lesion was observed in the maxillary right 1<sup>st</sup> molar, #16. The teeth was tender to percussion and mobility was within physiological limits. Pulp sensibility testing of the involved teeth with heated gutta-percha (DentsplyMaillefer, Ballaigues, Switzerland) and Dry Ice (R C Ice; Prime Dental Products Pvt. Ltd, Mumbai, India) caused an intense lingering pain, whereas electronic pulp stimulation (Parkel Electronics Division, Farmingdale, NY) caused a premature response. Preoperative radiographic evaluation showed deep carious lesion maxillary 1<sup>st</sup> molar, #16 approaching the pulp space. A diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made and a conventional root canal treatment for tooth #16 was planned for the patient.

The tooth was anesthetized with 2% lignocaine containing 1:200000 epinephrine. An endodontic access cavity was established under rubber dam isolation and canals were located. Coronal enlargement was performed with a

nickel-titanium (Ni-Ti) ProTaper (PT) series orifice shaper (DentsplyMaillefer, Ballaigues, Switzerland) to improve the straight-line access to all the root canal orifices. During instrumentation unfortunately protaper s2 niti instrument was separated in mb canal. A radiograph was taken to confirm the position of instrument in the canal and decided to try and by pass the instrument before attempting more complicated approaches. Bypassing was attempted using a size 08-10 stainless steel K-Files for searching for a way to bypass the instrument and succeeded in bypassing the broken fragment and reestablishing patency, and confirmed with the help of a radiograph (fig 1). For further exploration, a future early visit was planned for the patient. An intra-canal dressing with calcium hydroxide paste (Calcur; VOCO, Cuxhaven, Germany) was placed into the root canals using a Lentulo Spiral (DentsplyMaillefer). The access cavity was sealed temporarily with a cotton pellet and Cavit (3M ESPE AG, Seefeld, Germany). On the second visit, the access cavity was re-entered under local anesthesia. Patency of canals were established and Cleaning and shaping were performed using PT Ni-Ti rotary instruments with a crown-down technique. Irrigation was performed using normal saline, 2.5% sodium hypochlorite solution, and 17% EDTA; 2% chlorhexidine di-gluconate was used as the final irrigant. The canals were dried with absorbent points, and obturation was performed using cold lateral compaction of gutta-percha and AH Plus resin sealer (MailleferDentsply, Konstanz, Germany). The tooth was then restored with capsulated GIC GC Fuji IX GP (GC Corp,Tokyo, Japan)(fig 2) .The patient was advised a full-coverage porcelain crown and was asymptomatic during the follow-up period of 12 months (fig 3).

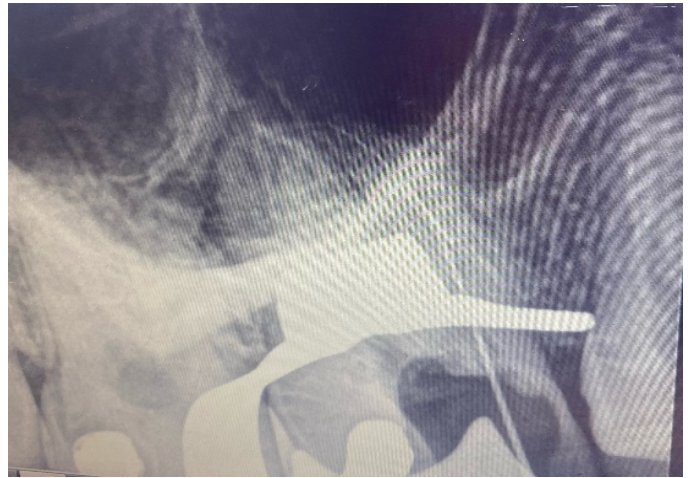


Fig. 1: Bypassed Broken file and established patency



Fig. 2: Post obturation radiograph

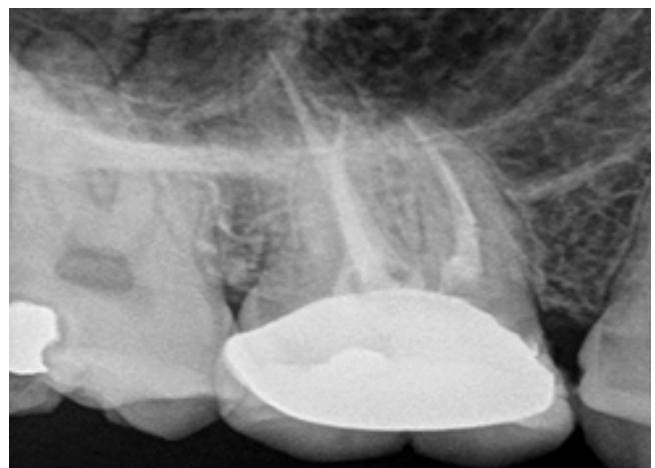


Fig. 3: Radiograph taken during 12 month follow up

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