Review Article

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RETRIEVAL OF SEPARATED INTRACANAL INSTRUMENTS: A REVIEW

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ABSTRACT:

Clinicians are frequently challenged by endodontically treated teeth that have obstructions, such as hard impenetrable pastes,separated instruments, silver points or posts in their root canals. Intracanal separation of endodontic instruments may hinder cleaning and shaping procedures within the root canal system, with a potential impact on the outcome of treatment.This article presents an overview of the literature regarding management of sepaerated intracanal instruments.

Key words: instrument fracture,Niti, instrument retrieval

INTRODUCTION:

Occasionally during nonsurgical root canal therapy, an instrument will separate in a canal system,blocking access to the apical canal terminus. This instrument is usually some type of file or reamer but can include Gates-Glidden or Peeso Drills,lentulo spiral paste fillers,thermomechanical gutta percha compactors,or the tips of hand instruments such as explorers or gutta percha spreaders.It is useful to expose a check radiograph after removal of the root filling to see if there is any metallic obstruction in the canal. 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 incidence of hand instrument separation has been reported to be 0.25%[(1)] ;for rotary instruments, it ranges from 1.68% to 2.4%.[(1,2)]

The advent of nickel titanium alloys has not resulted in a lower incidence of instrument separation whereas separation rates of stainless steel instruments have been reported to range between 0.25%and 6%.The separation rate of NiTi rotary instruments has been reported to range between 1.3% and 10.0%[(3,4,5-13)] .

When an instrument separate in a root canal ,2 main concerns needs to be addressed to maximize the long term – treatment outcome .the first is the existence of a metal fragment inside the tooth and the possibility of corrosion.[(14)]. Success of nonsurgical fractured instrument

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removal from root canals depends on the canal anatomy, the location of the fragment in the canal, the length of the separated fragment, the diameter and curvature of the canal itself, and the impaction of the instrument fragment into the canal wall.[15].

This article presents an overview of the techniques to retrieve separated intracanal instruments.

Techniques to remove separated instruments

During the past several decades many devices ,techniques ,and methods have been described for removal of separated instruments.

Softened gutta percha point: A simple technique to remove loose fragments located in in the apical third of the root canal by using Softened gutta percha points was reported by Rahimi and Parashos.[16]Initially, using stainless steel Hedstro¨m files 8, 10 and 15 , instrument could be partially tried to be bypassed . Following this, the apical 2–3 mm of a size 40,0.04 taper gutta-percha point (Dentsply Maillefer, Ballaigues, Switzerland)is dipped in chloroform (S.D. Fine Chem, Mumbai, India) for approximately 30 s. The softened gutta-percha is then inserted into the canal and allowed to harden for approximately 3 min.Using careful and delicate clockwise and counter clockwise pulling action,the gutta-percha point and fractured instrument is then successfully removed.[16]

It is a conservative, safe and plausible technique for removal of loosely fractured instruments in hard to access areas of the canal.

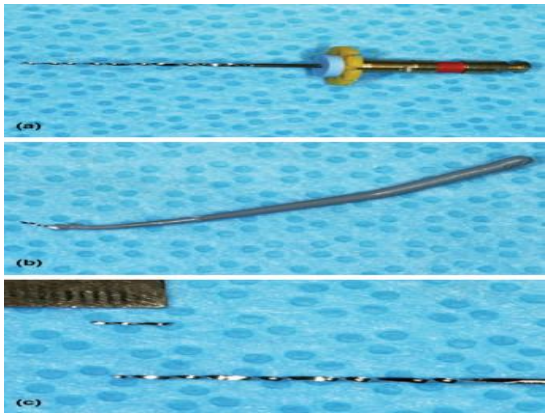


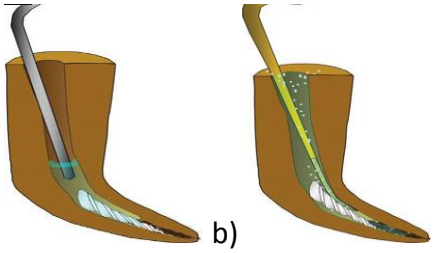
Figure 1. (a) Shows fractured 25/0.02 RaCe rotary file (b) Chloroform softened texture of a 40/0.04 taper gutta-percha cone with attached fractured instrument at the apical tip. (c) Fractured 25/0.02 RaCe rotary file tip (courtesy of Dr. Rahimi and Dr.Parashos)

Broach and cotton: Barbed broach with a small piece of cotton roll twisted around it can be used to remove separated barbed broach which is not tightly bound to root canal .broach along with the cotton roll ,is inserted inside the root canal to engage the fragment;then the entire assembly is withdrawn .[17]

Mini forceps: An instrument which is separated in a more coronal portion of the root canal can be grasped and removed by using a mini forceps such as steiglitz forceps(Union Broach,York,PA) or Endoforceps(Roydent,Johnson City,TN)[17]

Chemical solvents: Chemicals like EDTA can also be used to remove the fractured segment from root canal since it helps in softening root canal wall dentin ,facilitating the placement of files for the removal of fragment.[18]other chemicals such as

sulphuric acid,nitric acid,iron chloride ,iodine trichloride have been used in the past to achieve intentional corrosion of metal object.



a) b)

c)

Figure 2.a)Chemical solvent placed in the canal.b & c) fractured segment loosened and pulled out of the canal.

Wire loops: This technique can be used to retrieve objects that are not tightly bound in the root canal.A wire loop can be formed by passing the 2 free ends of a 0.14-mm wire through a 25-guage injection needle from the open end until they slide out of the hub end. By using a small mosquito haemostat,the wire loop can be tightened around the upper free part of the fragment,and then whole assembly can be withdrawn from the root canal.[19]

a)

b)

Figure 3.a)wire loop placed around the fractured segment. b)fractured segment pulled by tightening the loop around it.

Hypodermic surgical needle: The bevelled tip of a hypodermic needle can be shortened to cut a groove around the coronal part of the fragment by rotating the needle under light apical pressure. The needle size should allow its lumen to entirely encase the coronal tip of the fragment, which guides the needle tip while cutting so as to remove the minimum amount of dentin[20] . Counterclockwise rotation may enhance removal of instruments with right-hand threads and vice versa. The groove (trough) around the fragment can also be prepared by using thin ultrasonic tips or trephine burs. To remove the fragment, a cyanoacrylate glue or strong dental cement (e.g. polycarboxylate) can be inserted into the hypodermic needle, and then (when set) the complex (needle-adhesive-fragment) can be pulled out delicately in a clockwise or counterclockwise rotational movement. Roughening the smooth lumen by small burs can enhance the bond[21]

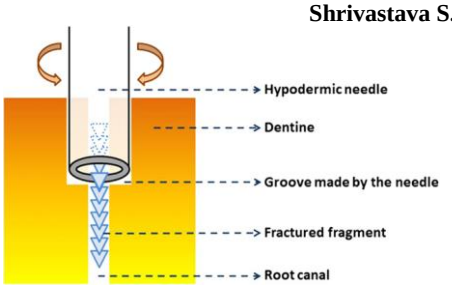


Figure 4. The shortened tip of a hypodermic needle is rotated in a counterclockwise or clockwise direction (under light apical pressure) to cut a groove around the coronal part of the fractured fragment. As the needle advances apically, its lumen encases the coronal tip of the fragment.

Masserann kit: The Masserann kit (Micro-Mega, Besanc on, France) consists of 14 hollow cutting-end trephine burs (sizes 11–24) ranging in diameter from 1.1–2.4 mm and 2 extractors (tubes into which a plunger can be advanced). The trephines (burs) are used in a counter clockwise fashion to prepare a groove (trough) around the coronal portion of the fragment. When inserted into the groove and tightening the screw, the free part of the fragment is locked between the plunger and the internal embossment. The relatively large diameters of extractors (1.2 and 1.5 mm) require removal of a considerable amount of dentin, which may weaken the root and lead to perforation or postoperative root fracture[22,23]

Headstrom files: A hedstrom file can be inserted into the root canal to engage with the fragment and then withdrawn. This method can be effective when the fragment is located deeply into the canal and not visible and the clinician is relying on the tactile sense[24,25]

Extractors: The concept behind the Masserann technique has been further developed, and new extractors have been introduced. The Endo- Extractor system (Roydent) has 3 extractors of different sizes and colours (red 80, yellow 50, and white 30). Each extractor has its corresponding trephine bur that prepares a groove around the separated instrument. The Cancellier Extractor Kit (Sybron Endo, Orange, CA) contains 4 extractors with outside diameters of 0.50, 0.60, 0.70, and 0.80 mm. The Instrument Removal System (Dentsply Tulsa Dental, Tulsa, OK) contains 3 extractors. The black extractor has an outside diameter of 1 mm and is used in the coronal one-third of larger root canals. The red and yellow extractors (0.80 and 0.60 mm, respectively) are used in narrower canals. Recently, new systems have been introduced into the market. The Endo Rescue (Komet/Brasseler, Savannah, GA) consists mainly of a center drill called Pointier that excavates dentin coronal to the fragment and trephine burs that rotate in a counter-clockwise direction to remove the fragment. These instruments are available in 2 sizes, 090 (red) and 070 (yellow). The Meitrac Endo Safety System (Hager and Meisinger GmbH, Neuss, Germany) is another new system that has 3 sizes of tubes.[26]

Ultrasonics: Success rates for fragment removal by using ultrasonics in clinical trials have ranged from 67 % by Nagai et al41 to 88 % and 95 % reported recently by Cuje et al and Fu et al ,respectively. Ultrasonic instruments have a contra-angled design with alloy tips of different lengths and sizes to enable use in different parts of the root

canal. Most ultrasonic instruments have an SS core coated entirely with diamond or zirconium nitride; therefore, the instrument abrades along its sides in addition to its tip. By contrast, the titanium-based tips have a smooth surface (uncoated) and can cut only at their tip. Although companies claim that these tips are flexible and can penetrate into curved root canals, blind trephining of dentin may lead to undesirable consequences. A staging platform is prepared around the most coronal aspect of the fragment by using modified Gates Glidden burs (no. 2–4) or ultrasonic tips [27].The Gates Glidden bur is modified by grinding the bur perpendicular to its long axis at its maximum cross-sectional diameter. The platform is kept centred to allow better visualization of the fragment and the surrounding dentin rootcanal walls; therefore, equal amounts of dentin around the fragment are preserved, minimizing the risk of root perforation. The ultrasonic tip is activated at lower power settings, so it trephines dentin in a counter clockwise motion around a fragment with right-hand threads and vice versa. With this trephining action and the vibration being transmitted to the fragment, the latter often begins to loosen and then ‘‘jumps’’ out of the root canal. Other root canal orifices in the tooth, when present, should be blocked with cotton pellets to prevent the entry of the loose fragment. If little care is taken and excessive pressure on the ultrasonic tip is applied, the vibration may push the fragment apically or the ultrasonic tip may fracture, leading to a more complicated scenario. The activated file should be of a tip size that enables trephination of dentin around the fragment. However, files that are too small should not be used because they are themselves prone to separation. Also, a spreader can be modified to a less tapered and smaller tip-sized instrument that can be activated to trephine deeply around a fragment[28] .

Novel future techniques

Electrochemical dissolution of fragment: It is a new concept based on electrochemical –induced dissolution of metal tested by Orniga et al[29].Two electrodes are immersed in electrolyte where one act as a cathode and another as anode. The contact between the separated file and anode as well as an adequate electrochemical potential difference between the anode and cathode electrodes results in the release of metallic ions to the solution ,consequently causing progressive dissolution of the fragment inside the root canal. Despite its limitations (long duration required for complete fragment dissolution and the limited root canal space to accommodate the electrodes), results are promising .Further studies to develop the technique are required before it is adopted clinically.[29].

LASERS: The Nd:YAG laser has been tested recently for removal of separated instruments by YU DG et al and Ebihara et al[30,31]. It is claimed that minimum amounts of dentin are removed , reducing the risk of root fracture .additionally, fragments can be removed in a relatively short time(less than 5 minutes) in 2 ways: (1)the laser melts the dentin around the fragment and then H files are used to bypass and then

remove it, and (2)the fragment is melted by the laser.[30,31]

DISCUSSION:

A separated instrument does not necessarily mean surgery or loss of the tooth[32] .The presence of a separated instrument in the canal in itself does not predispose the case to post treatment disease. Rather , it is the presence of any necrotic, infected pulp tissue that remains in the apical canal space that determines the prognosis. The outcome is better if the canal was instrumented to the later stages of preparation when the separation occurs[33]

If the file can be removed without excessive overenlargement of the canal or causing an additional iatrogenic mishap such as a perforation, the perforation, the prognosis will not be affected. By passing the instrument and incorporating it into the obturation should be followed closely.

Instrument removal techniques such as the Masserann-kit(Masserann 1966), ultrasonics (Chenail & Teplitsky 1985, Souyave et al. 1985, Nagai et al.1986, Nehme 1999, Ward et al. 2003a,b), use of adhesives such as cyanoacrylate(Coutinho Filho et al. 1998), the tube and Hedstro¨m technique (Suter 1998) and use of chemical agents such as iodine trichloride (Hu¨ lsmann 1993) are not conservative and/or safe options for removal of fractured instruments especially in difficult to access areas of the canal. The use of ultrasonics such as Endosonore (Dentsply Tulsa, Johnson City, TN, USA) stainless steel files with copious irrigation to remove loosened fractured instruments is another conservative technique. However, there is a possibility of excessive dentine removal and fracture of such files in severely curved canals such as the case described here(Souyave et al. 1985, Hu¨ lsmann 1994). In comparison to the above techniques, the softened gutta-percha removal technique is a conservative technique in that it does not require dentine removal, is simple and quick to perform, and does not require direct vision or straight line access.[34-45]

CONCLUSION:

There exist no standardized procedure for successful and guaranteed removal of separated instrument from root canal.Among the various techniques available, the ultrasonic endodontic device advocated for retrieval of fractured instruments is highly effective as its use is not restricted by position of fragment in the root canal or tooth involved.Improved visualization combined with a conservative approach, balanced with favourable prognosis is the treatment option of choice.

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