

The Use of a Chelating Agent and Ultrasonic Tips in the Retrieval of Broken Rotary Ni-Ti

Philippe W Sleiman, CD-D.E.S.E.

The purpose of this article is to correlate the importance of irrigating with chelating agents (and their chemical reaction in eliminating the debris from between the flutes of separated nickel titanium files), with the ability to retrieve and/or bypass instruments separated within the root canal system.

Several methods and techniques have been advocated over the years for the removal of solid objects such as silver points and fragments of endodontic instruments that have been separated. If the coronal aspect of the fragment to be removed is accessible, it has the ability to be withdrawn from the canal by a variety of instrument systems. Examples of such systems include but are not limited to the Masseran™ Endodontic Kit (Micro-Mega, Lynne-wood, Washington),¹ the Cancellier Instrument Removal System™ (SybronEndo, Orange, CA) and the Ruddle IRS™ (Dentsply, Tulsa, OK). Recently, the use of piezoelectric ultrasonic units with their numerous compatible tips

have facilitated the incremental removal of dentin surrounding separated instruments as well as their vibratory removal.² The use of a chelating agent will be shown to facilitate the removal and/or the dissolving of the debris trapped between the instrument flutes and the debris caught between the instrument itself and the dentinal wall.

MATERIALS AND METHODS

The irrigation protocol used in this clinical study included the alternating use of a citric acid “50%” chelating solution, distilled water and chlorhexidine 0.12 or 0.2%.

One of the most important factors prior to instrument removal is the creation of a reservoir coronal to the separated fragment in order to receive the liquid.³

This reservoir can be created with the use of modified gates glidden drills, #1 and #2 sectioned at their maximum cross-sectional to obtain a flat end and a predictable caliber (gg1=50, gg2=70), and an LA access bur (Sybron Endo)

of appropriate size. The objective here is to create straight line access to the coronal aspect of the separated fragment for predictable removal as well as to provide a reservoir to hold an adequate volume of solution.

Sodium hypochlorite is probably the most widely used irrigant for root canal preparation.⁵

For this procedure sodium hypochlorite is not recommended because this irrigant targets organic tissue and not the inorganic tissue that is meant to be demineralized in this situation. Citric acid has been recommended as a canal irrigant because of its ability to demineralize and to remove the smear layer⁶ which is thought to be mostly inorganic. Wayman et al.⁶ showed that 10,25, and 50% solutions of citric acid were all effective in removing calcium when used as a root canal irrigant. The demineralization effect of citric acid is apparently very rapid. Using dentinal discs, it has been shown that a 6% solution of citric acid required only 5s to

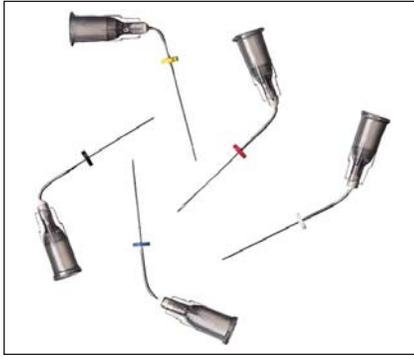


FIGURE 1—Stropko™ Triple syringe and Ni-Ti flex tips

FIGURE 2—The 4 Series Ultra Sonic Tips

remove much of the smear layer and exposed the orifices of the dentinal tubules.^{6,8,9} The distilled water is used to wash out the citric acid and the chlorhexidine acts as an antimicrobial agent. The stropko™ Irrigator (Sybron Endo, Orange, CA) (Fig. 1) is also a very handy instrument to dry out the canal.

Once the reservoir has been created coronal to the separated fragment, a 50% solution of citric acid is used to fill it. The solution is brought in close contact with the fragment and the dentinal wall with a small caliber hand files such as a #06 or #08. The citric acid is then activated with a #15 ultrasonic file. This sequence is repeated frequently and small caliber precurved files are used in order to assure a good penetration of the irrigant and to try to create a path between the broken file and the dentine wall. This will allow the irrigant to be worked further apically and the fragment to be bypassed.^{3,7} With the use of the dental operating microscope identification of the broken file separate from the dentinal wall and obturation material will become much clearer.

Ultra sonic tips can be very useful in retrieving the separated instruments. The ultra sonic (piezoelectric) tips that are most useful are 4 Series (SybronEndo) consisting of three tips. The CT4 tip is the most robust tip and can be used at the highest levels, the

UT4, a tip of medium thickness can be used at medium levels, and the SJ4, the finest tip, and should be used at the lowest power levels (Fig. 2).

The 4 Series tips are used in sequence a crown down manner from large size to medium size and then finally to small size. They should be introduced into the canal in contact with the broken file, activated for one or two minutes. They should be handled with a light touch and always kept in close contact with the exposed tip. Neither push pull movement nor excessive force should be applied as the objective is only to transmit vibration to the separated fragment so that it may be dislodged or further fragmented. This maneuver can be repeated several times, until the canal space is cleared.^{2,3}

The first step is time-consuming and may need twenty to thirty minutes depending on canal configuration, canal length and position of the broken file. This technique is used in the straight coronal portion of the canal. If the separated fragment is located apical to the curve, and straight line access can't be achieved then adequate vibrations can't be delivered. In these cases, we often must be content by bypassing the separated instrument if it's possible.^{1,3,7} The use of the dental operating microscope with fiberoptic illumination is very crucial for maximum predictability.

CASE REPORT ONE

Examination of the pre-operative radiographs reveals clearly the calcifying canal space of the two mesial root canals. (Fig. 3). This represents a contraindication to initiate shaping with Ni-Ti files without first preceding them with stainless steel files and creating a glide path. Ignoring this point led to separation of two Ni-Ti files, one in each root (Fig. 4). The case seems hopeless at this point.

Each root was treated separately with a lot of attention and time to provide a proper result.

Although patency was finally achieved there were certain risks associated with this success. As seen in this postoperative radiograph the risk of a stripping was very high. Nonetheless the case may be described as a success if one considers the perfect seal of the root canal system, and a failure if one considers the amount of dentin lost in the retrieval process.

CASE REPORT TWO

The second case shows a rotary Ni-Ti files separated in one of the mesial roots (Fig. 5), the location which appears to be impossible to see it under the microscope. Citric acid was placed into the canal and



FIGURE 3



FIGURE 4



FIGURE 5



FIGURE 6



FIGURE 7



FIGURE 8

small hand files were used to create a bypass. A Pathfinder™ (Sybron Endo, Orange, CA) were useful in bypassing the separated files. The challenge was to reach working length and achieve patency at the apex and not to create damage in any way, such as ledging or perforation. Figure 6 shows the post op treatment result.

CASE REPORT THREE

Two rotary Ni-Ti files were separated in this case. One was separated in the distal canal and one in the mesial canal (Fig. 7). The files were very tightly caught between the canal walls and the challenge here was to retrieve them in total from both canals, especially the one in the distal root that was separated beyond the apex. Figure 8 shows the post treatment result.

CONCLUSIONS

The most ideal management of separated instruments is to prevent the occurrence in the first place. The mesial root of lower molars often presents a specific

challenge. A second curve (buccolingual) not seen on the radiograph combined with the mesio-distal curve offers a perfect trap for Ni-Ti files and 60 to 70% of all file separation occurs in this mesial root.

The irrigation protocol, the delivery and the sequence in which they are delivered is paramount when considering removal of the smear layer as well as the debris caught between the flutes of the files.

Ultra sonic tips are very handy instruments in these clinical situations, but care must be taken as the root canal is a very tiny space and any damage created, such as a perforation, ledging or weakening of the canal walls may be irreversible, leading to the loss of the tooth. The use of the dental operating microscope is not an option when treating the situations as described, but a must!

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Dr. Sleiman is the former Acting

Head of the Endo Department at the Lebanese University. He is responsible for the Prodent Endo training center in Beirut is an international speaker in endodontics, collaborates in several ongoing research endodontic studies, and has a private practice limited to endodontics.

Oral Health welcomes this original article.

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