

Reflections on the Current Status of Multiple Ni-Ti Rotary File Use in Endodontics

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OK, so a couple of months ago I'm all ready to put together a short paper on the problem of Ni-Ti file breakage. I research MedLine and start writing. Then I see that a comprehensive article on this subject has been published in the Nov JOE (Rotary Ni-Ti Instrument Fracture and its Consequences by Parahos and Messer – JOE Vol 32 No.11 – I've enclosed the .pdf) It's pretty comprehensive and has an extensive list of 174 references! Hmmm, bad timing on my part but it is relevant to discussions we recently have had on ROOTS. While the paper was an excellent review of the problem, it didn't answer several practical questions facing clinicians who use Ni-Ti rotaries. The paper failed to address the real issue facing clinicians – the concept of “file economics”.

The greatest method of prevention of file separation is the creation of a proper access and glidepath. A recent Hands-On Demo I did with Kens Serota again showed that we as Endodontists still have a lot of work to do trying to make clinicians appreciate how important the access cavity is in prevention of breakage. Most clinicians spend far too little time on access and want to drive their Ni-Ti rotaries to the WL as soon as they can. The way we lessen breakage really has nothing to do with the instrument design since the literature shows that they will all break when used improperly, no matter which brand.

The rate of rotary Ni-Ti file breakage reported by some ROOTers appears to be small (less than 1% for many clinicians AND corresponds to the figures quoted in the article) but the issue of multiple use does represent a larger potential problem for some Dentists in specific parts of the world. Breakage may seem a trivial issue to some N. American or European based clinicians but clinicians living in less affluent areas of the world have a different perspective. Many of these countries have not reached the level of Dental sophistication that permits those that set treatment fees to appreciate the differences between well done and poorly done Endodontics. Fees for Endodontic treatment in these locations are very low and multiple instrument use is not only common but a financial necessity. In other locations, the clinical sophistication may be there but government intervention (socialized Dentistry), reimbursement ceilings created third party insurers or lack of patient funds may strongly influence how Endodontic treatment is delivered and the level at which compensation for Endodontic services is paid. The result can be the need for routine instrument “re-use” – a subject that has never been seriously studied as a practical matter. Because of the reluctance of manufacturers to recommend such use, it is unlikely that serious studies will be undertaken, funded or sponsored by them. So what is the clinician to believe? How best to use them? Can they be reused safely?

When it comes to Ni-Ti Rotary instrument use (or re-use), clinicians generally fall among three broad categories:

Category #1. - The Marie Antoinette Philosophy - “Let them eat cake”

This philosophy is more prominently espoused by certain US based, high profile (no pun intended) Endodontists, many of whom coincidentally have a patent or royalty/financial

agreement with the manufacturer. They basically say: "I enjoy the confidence I experience when I use a new set of instruments for each case. I like this feeling so much that I have made arrangements for my patients to pay for that feeling. My patients very rarely complain about the extra \$40 or \$50 US new instrument surcharge. It's just not a problem in my world. " I'm not exactly sure, but I think it would be a safe bet to say that these Endodontists either don't pay the same amount as you and I for the instruments they co-invented or get many "evaluation samples" for free. So their advocacy of "Single Use and Toss" really amounts to nothing more than "faux" extravagance on their part. In more affluent areas, it is very easy to justify this extra "new instrument" fee, which in many cases may represent as little as a 3% (or less) increase in the total cost of the endo treatment. But as the JOE paper says, sometimes even these brand new instruments can break. So merely suggesting that we use a new set for each case is not the perfect solution either.

Category #2 "Take your Best Guess" Philosophy

This philosophy involves trying to gauge the "Use Level" of the files. Most often this is determined by the clinical operator (Dentist) who tries to determine how stressed the files have become when performing treatment. In some instances, rubber petals or stops may be changed to indicate number of uses; others have assistants use different storage or marking methods to indicate the "Use Level" of a particular file or set of files. All of this is basically guesswork because there is no true way to determine the stress level of a file simply by visual determination or by "feel". I suppose there may come a time when we may develop a coating or device that will give us a clue as to the stress level, but it will no doubt increase the costs of files further. Until then estimating file stress is sheer speculation and guesswork. The result (especially when pushing file usage to the limits) will inevitably be more broken files. This will occur less frequently than that in category 3...but because the stress level cannot truly be determined visually (other than by obvious physical deformation) – this WILL happen....often unpredictably. The JOE article offers no real solutions to this dilemma.

Category #3 "Use em til they break" philosophy

The other end of the spectrum is represented by the "Use them 'til they break" philosophyor something similar. This philosophy is espoused by many clinicians outside of the US, where molar fees are often a fraction of the US \$1000-1500 (+/-) Endodontist fees that are obtained by those advocating position #1. Instruments are so expensive (relative to treatment fees) that it is impractical to toss them after a single use. They are routinely used long after the time recommended and sometimes until they break. There is no chance that clinicians in this position will ever be likely to "use once and toss" until the Ni-Ti rotary file becomes priced at the level of a SS file. I think it is safe to say that Ni-Ti file manufacturing costs suggest this will not happen in the foreseeable future.

Ironically, most of these same clinicians are also unlikely to be able to afford a scope – (which is pretty much a necessity if you ever hope to remove that 15 times-used file fragment that you have just broken in the mid canal space!) There are exceptional clinicians in these locations who do own scopes, but they are rare. Even so, spending much of your day at high magnification, retrieving broken files is not the most efficient, productive or leisurely way to make an Endodontic living.

Each of us has to determine to which of the three groups we belong. In the United States (and in some other countries) the possible legal risks of multiple file use (fracture) may eventually dictate that endodontic files are "single use only" instruments. Then there will be

no option. There may simply be no legal defense when instruments are clearly stamped "single use only" on the package and you break them in the 2nd or 3rd use.

File Breakage

But you are a more conscientious clinician – you ensure glide path on every canal. You don't break files very often. That's OK, but what do you do when a case is referred to you with a broken file? That's another contentious point. What are the risks of leaving files in canals vs. the risks of trying to remove them? We don't know for sure. The JOE paper points out there have either been (a) too few studies of the effects of broken files on prognosis, or (b) the few studies that have been performed involved so few patients that the results are probably not statistically significant. The prognosis is also dependent on file location, prior condition of the pulp, presence or absence of a LEO and many other factors. Each case is different. The paper offers a good flowchart to help us determine which strategy is best when faced with a broken file.

We seem to have 4 different strategies when coping with the broken file:

1. Aggressive Retrieval.

If you are fortunate enough to be able to visualize the fragment with a scope. (And don't even bother to try to do this without one!) Dentin will be sacrificed. There's no way around that. Yes, there are those that say "If you can open the case large enough to retrieve an instrument via straight line access, you can open it large enough initially...to prevent separation in the first place." That is cold comfort when that broken file referral comes in the mail. There are lassos, tube/core paste, IRS and stage/platform and ultrasonic methods. That assumes that the instrument separation occurs in a relatively straight part of the visible canal and that there is sufficient dentin thickness to allow for retrieval.

The literature clearly shows one thing: Prognosis generally goes down with time spent on retrieval. The longer you spend screwing around in there, the more frustrated you get and the more likely you are to hog the root out or perf in your retrieval attempt. And THEN what do you have – a compromised tooth? It's especially infuriating when the tooth is vital and without periradicular pathology or symptoms when separation occurs. Now, for the practical aspect not discussed in the paper: The truth of the matter is that these methods can take literally hours in difficult cases. Relative reimbursement (unless strictly based on \$/time) will almost always be less than your normal production rate. When considering a retreatment scenario, factors such as increased cost, possible need for disassembly and ultimate prognosis make the implant option appear as an increasingly attractive alternative for the broken file patient.

So, in our rush to become more "efficient" with our instrumentation methods, issues with potential breakage may actually provide ammunition for those who feel implants will replace Endodontics as treatment of choice. The only saving grace in less affluent countries is that if patients can't afford Ni-Ti, they certainly will be even less likely to be able to afford an implant. So, you're much more likely to leave the file in place. What next?

2. File Bypass

I have had the best success using this method. One of the big advantages of using the ProTaper system is the file design. Although no one wants to intentionally break a file, the multi-tapered design of this file generally prevents true taper lock all the way up the

file fragment. In the event of separation, the result is that you can usually negotiate a #6 or #8 hand file past the flutes of the broken file and then either carefully work the separated instrument out of the canal with hand instruments, or bypass it and incorporate it into the filling material. This method generally allows for far greater conservation of tooth structure, can offer some time savings and a more conservative approach than attempting outright retrieval. In my 20+ years of private practice experience with separation of both hand and engine driven files, this seems to work best. But, again, virtually no studies have been done to compare success rates of conventional treatment with that of "bypassed instrument" treatment. A search of PubMed showed that there never has been a good study that compared cases with bypassed files vs. normally treated and root filled teeth. If you live in a location where files are frequently reused and you DON'T have a scope, you had better learn how to bypass a broken file. (*I think this will be my next paper. I've broken enough reamers in my career to know how to do this well.*)

3. Leave it and pray

Some files can not be either bypassed or retrieved. There is general agreement in the limited amount of anecdotal literature that vital cases respond better to the "leave the file and fill to it" philosophy. There is a general consensus that breaking files in nonvital cases or cases with LEOs have a poorer prognosis simply because of the untreated infected remnants in the inaccessible apical canal space. This seems logical. That leaves the final alternative: Periradicular Surgery.

4. Surgerize

In rare instances (just as in cases where posts/complex fixed prosthetics obstructs our ability to perform conservative retreatment) it may be necessary to surgerize the root to remove the offending canal space remnants and to affect apical seal. Unfortunately file breakage occurs most frequently in molars (especially mesial roots of mandibular molars) which can be a tough surgery even for experienced clinicians. Without a scope, ultrasonic microsurgical instruments and good visibility it becomes almost impossible to do a good job in these tough surgeries. Without a scope there is also a tendency to bevel too much and to miss isthmuses. So again, extraction is usually what happens – generally with fixed or removable prosthetic replacement. More fodder for the Implantologists.

Dr Bassi recently wrote on ROOTS: [We developed software which controls the NiTi use \(stress\) based on the stress \(torsional and flexible\). At the equip display, a percentage indicate how much "life" you still have \(in the file\). It is a year and half software and the results have shown up to 50% more number of reuses. In general, we can treat about 10 to 12 molars and there are lot other advantages.](#)"

I think we would all be very interested in seeing this device and how it works. I am hoping that he can be persuaded to join us at the next ROOTS Summit VII in Miami and present his findings. He probably won't be well regarded by the file manufacturing industry but I'd be one of the first to invest in a machine or software that could help determine more accurately how much "life" is left in a file.

The Hand File Alternative

A final alternative for those who are not in the position of replacing instruments frequently and do not wish to risk breakage is to either consider and hand filing/reaming method. This is the classic Schilder EOM method I described in my recent paper. It is done with

inexpensive SS hand reamers that can be turned in the hand (and can attain speeds close to the 300 rpm recommended by Ni-Ti rotary file manufacturers.) Yes, it is a slower method, but this is the “poor man’s ProTaper” in its purest form. And it has been used by Boston U. graduate students for several decades with excellent results. The advantage of using a reamer to its cutting limit is that you generally have the sensation of unwinding the file BEFORE it breaks AND your assistant can examine these inexpensive instruments for physical deformities that can reduce your breakage rate. In places where endodontic fees are very low I am surprised that this method has not gained general acceptance. Perhaps it is just that it is not fully understood or known.

Conclusions

So, we have a choice. Assuming that we have created the proper access and glide path, we can:

1. Be extravagant with Ni-Ti rotary instruments (single use) and try to reduce breakage that way. Costs be damned. The patient pays.
2. Try to assess file use (multiple use) and occasionally be wrong. Russian roulette. Guess wrong and it is you that pays when you have to spend the time to bypass or remove a file (at YOUR cost.)
3. Accept that repeated use will result in higher rates of breakage and become familiar and adept at bypassing files. Accept file breakage as routine – the cost of reuse.
4. Learn retrieval methods for broken files. (This assumes that we have a scope)
5. Use a slower combined hand/rotary Ni-Ti technique that essentially negates many clinicians’ reasons for using Ni-Ti (greater speed and less hand fatigue.)
6. We can also try a non Ni-Ti hand reamer/file method that provides for greater latitude of instrument abuse, albeit at a slower production pace.

Endodontists understand one thing: It is very expensive to break a file. We must also understand that ideal treatment is not possible for many places in the world. If we make the costs of endodontic treatment so unaffordable for patients and so out of reach financially for many dentists, there will be abuse of instruments. Instrument abuse and fracture could contribute to a general perception that Endodontics “doesn’t work”, is “too difficult” or that “overhead costs to do proper treatment to the level of the state of the art are simply impractical.” Endodontics will be best served in most places in the world by giving clinicians a solid foundation in the rationale of Endodontics, recognition and appreciation of canal anatomy and knowing how to create proper access. These tools (which cost little!) are our best defense against the Implantologists and those who regard endodontic treatment and retreatment with disdain.

The time you spend creating proper access and understanding the nature and anatomy of the canal system will pay dividends with lesser file breakage. And if you must reuse files – spend the time necessary to prepare the coronal aspect of the tooth to receive them in the least stressful manner possible.