

# Endodontics: the F factor

## Dentsply explains how to minimise the chances of file separation occurring

It's an unfortunate fact in dental procedures that complications can occur, and chief amongst them is the problem of file separation in endodontics. Not only is this a problem for the clinician, it can also cause great distress to the patient, as well as post-treatment complications. Although it is not possible to totally eliminate file separation, understanding the contributing factors and choosing the right equipment can help clinicians implement preventive strategies and minimise the chances of it occurring.

### Factor one: fatigue

Successful endodontic treatment is dependent on the scrupulous cleaning and shaping of the root canal system, and the more complex the root canal system is, the greater the risk of file separation. Files undergo greater fatigue in curved canals through friction with the canal walls, as curved canals are generally found to be very narrow. The file needs to be kept moving to take it around a curve otherwise cyclic fatigue can rapidly occur and the file can eventually break. Keeping the file moving evens out the stress throughout the length of the instrument and therefore reduces the risk of breakage.

Excessive torque and cyclic fatigue are the most common factors that work to weaken a rotary file. If files reach a section of canal smaller than their diameter they can screw or lock into the canal walls, resulting in the torque rapidly increasing and subjecting the file to high levels of stress. Excessive torque can actually be seen as an unwinding of a rotary file in operation and fortunately the instrument can be quickly removed and discarded. The problem with cyclic fatigue is that it cannot be seen and is a result of the repetitive bending motion where it accumulates to a point where the next bend will cause the file to separate.

Files need to be kept well lubricated and should never be used in dry canals. Similarly, they should never be forced, as doing so will subject the instrument to further excess stress.

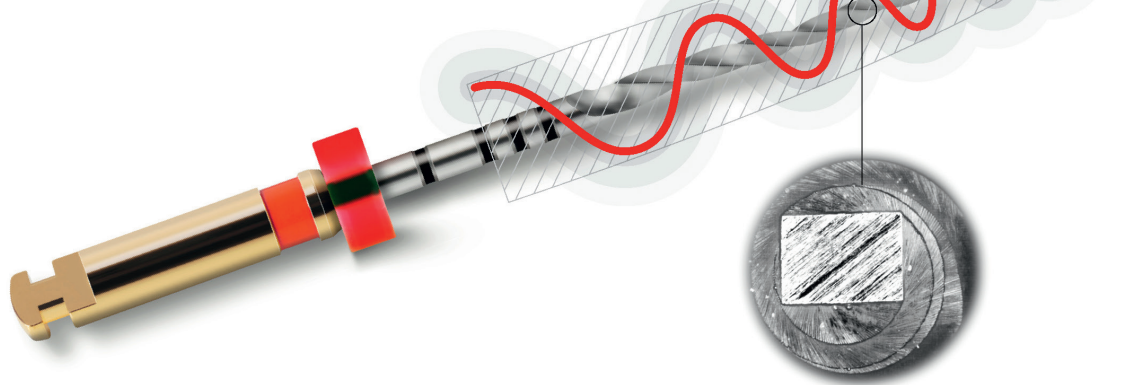
### Factor two: frequency

The simplest way to ensure file safety and prevent breakage is by adopting a single-use approach. Not only does this reduce the possibility of instrument fatigue caused by repeated use, it also removes the possibility of any cross-contamination. The design of endodontic files means they can be difficult to thoroughly clean and sterilise, and research has shown that certain bacteria and tissue remnants may remain on the instrument (www.dentsply.com, 2014). Reusing instruments can therefore increase the risk of cross-infection to subsequent patients.

HTM 01-05 touches on the problem of prion contamination that can theoretically be present on some instruments following contact with dental tissue, and the chief dental officer for England has published requirements for endodontic files. HTM 01-05 section 2.18 states: 'Where endodontic reamers and files are designated reusable, they should be treated as single patient use or single use – regardless of the manufacturer's designation – to reduce the risk of prion transmission' (www.gov.uk, 2013).

Similarly, using endodontic files for multiple cases can reduce cutting efficiency, increasing operator fatigue, lengthening the treatment time for the patient and ultimately affecting the overall clinical outcome. Studies have shown that on reusing nickel titanium files on human dentine, files have rapidly deteriorated and the decline in efficiency was significant, concluding that all endodontic files should be disposable (www.dentsply.com, 2014).

**Figure 1:** The flexibility of M-Wire has allowed for the development of an innovative off-centred rectangular cross section that gives the file a snake-like 'swaggering' movement as it moves through the root canal



**Figure 2:** Protaper Next X1 file



**Figure 3:** Protaper Next X2 file



**Files cannot be 100% guaranteed every time so stringent examination of files before and during treatment, using magnification if necessary, is essential to see any defects**

### Factor three: future technology

The introduction of nickel titanium rotary files in endodontic treatment has made clinical outcomes more predictable due mainly to their flexibility, especially through curved canals, when compared to stainless steel hand files. Greatly improving file systems and reducing incidences of file breakage, nickel titanium files have been reported to be three times stronger, more flexible and have superior resistance to torsional fracture compared with stainless steel files (Walia, Brantley and Gerstein, 1988).

The next generation Protaper Next file system has significantly decreased the risk of file breakage even further by introducing files constructed from M-Wire nickel titanium. The single file M-Wire nickel titanium system has improved strength and flexibility, while still retaining cutting efficiency. The flexibility of M-Wire has allowed for the development of an innovative off-centred rectangular cross section that gives the file a snake-like 'swaggering' movement as it moves through the root canal. The rotation makes it possible to shape more severely curved narrow canals and generate enlarged space for easier removal of debris that can cause blockages. It also reduces the incidence of binding around the file, further reducing the risk of file breakage.

The advances in Protaper Next means in the majority of cases only two shaping files are now needed for each clinical procedure, instead of four with its predecessor, and up to six with other systems. As sequences are

reduced less time is spent changing instruments, making treatment faster and more comfortable for the patient.

Reducing by half the number of files means the single use of endodontic instruments becomes more cost-effective. Single use also eliminates any risk of possible prion cross-contamination and virtually eliminates instrument fatigue resulting in file separation.

### Finally...

Although no manufacturer or clinician can ever guarantee that file separation will never happen, using appropriate preventive measures through the latest in file technology can go a long way to significantly reducing the risk.

Appropriate training to use files correctly and having a clear understanding of root canal anatomy is essential. Files cannot be 100% guaranteed every time so stringent examination of files before and during treatment, using magnification if necessary, is essential to see any defects. And, as always, follow the manufacturer's instructions for the safest patient outcomes. **D**

### References

Walia HM, Brantley WA and Gerstein H (1988) An initial investigation of the bending and torsional properties of Nitinol root canal files. *J Endod* 14: 346-351  
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