6. Why Rotary Instrumentation?

One benefit of mechanical rotation is the enhanced ability to collect and remove debris from the canal system. Hand instrumentation can push debris laterally into the intricacies of the canal anatomy or even apically through the canal foramen when using techniques that commonly include insertions of files without rotation or rotations of files in a counter-clockwise direction. In contrast, continuous clockwise rotation will convey debris only in a coronal direction from the canal ramifications and apical foramen.

Mechanical rotation provides a more constant 360 degree engagement of the file tip in the canal that forces it to follow the canal and results in better control for maintaining the central axis of the canal, reducing the incidence of ledging or perforating. The flexibility for following the canal allows us to be more conservative in preserving tooth structure while effectively cleaning and shaping the canal. The most obvious benefit for continuous rotation is the reduction in the time required for instrumenting the canal. The fact that a file constantly rotating from 200 to 2,000 rpm produces results more rapidly than hand instrumentation that has significantly slower and intermittent rotations should come as no surprise.

7. ***Why do we need to know anything about instrument design?***

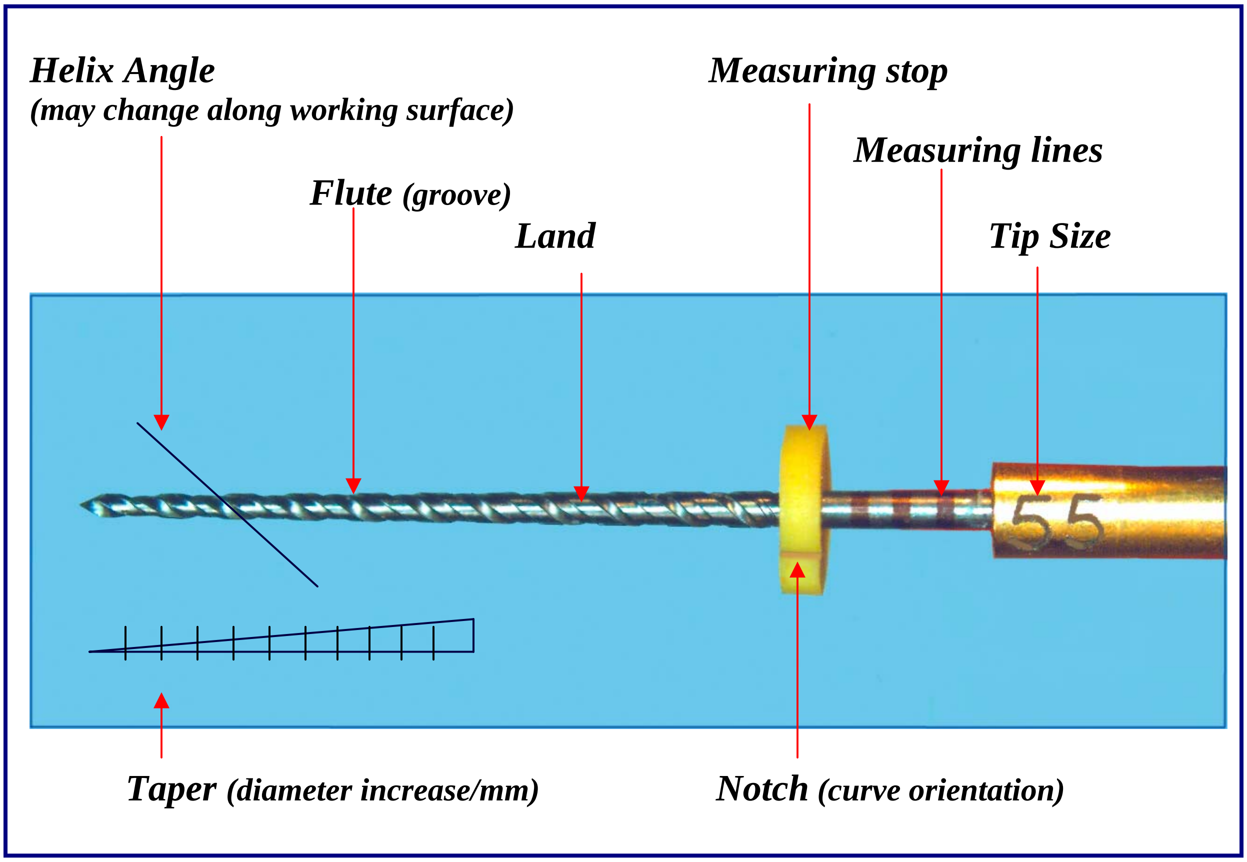
The capabilities of files made of the same material are entirely dependent on design and can mean success or failure. No one aspect of file design is indicative of the file's overall usefulness. Optimizing one design feature can compromise another benefit. Considerations for design effectiveness include cutting ability, operational torque, torque at breakage, flexibility, screwing-in forces, ability to maintain the central axis of the canal, and tip mechanics. The success of file design is determined by how efficiently it meets the requirements of the canal anatomy in relation to its resistance to torsion and fatigue failure.

Limitations of the initial nickel titanium file designs were largely due to an attempt to adapt the more easily manufactured old hand file designs and technique concepts to these new rotary instruments. These old designs applied to a new modality comprised the first generation of NiTi rotary instrumentation. A second generation of designs now particularly patterned for rotary instrumentation is being introduced that can substantially advance treatment results. In using any file design, understanding the rudimentary physics involved in its use is imperative for the practitioner to take full advantage of its benefits and to recognize instrument features that improve usefulness or pose possible risks. This need is especially important in employing a new file design. Regardless of the design and technique, there are certain considerations that provide the understanding for using rotary instrumentation to its fullest advantage. The practitioner must remember that although any new introduction of rotary files can represent significant improvements, some designs without merit will continue to be introduced for marketing purposes and advocated by clinicians who lack the complete comprehension for the ramifications of use. Any significant treatment advancement will ultimately be predicated on each individual practitioner's understanding of design function. The ultimate goal for anyone using rotary instrumentation is not only to be able to recognize that pivotal instant just before complications occur, but to recognize the most appropriate approach for achieving solutions. That goal can only be accomplished by thoroughly understanding the function of design.

8. Is an appropriate technique important?

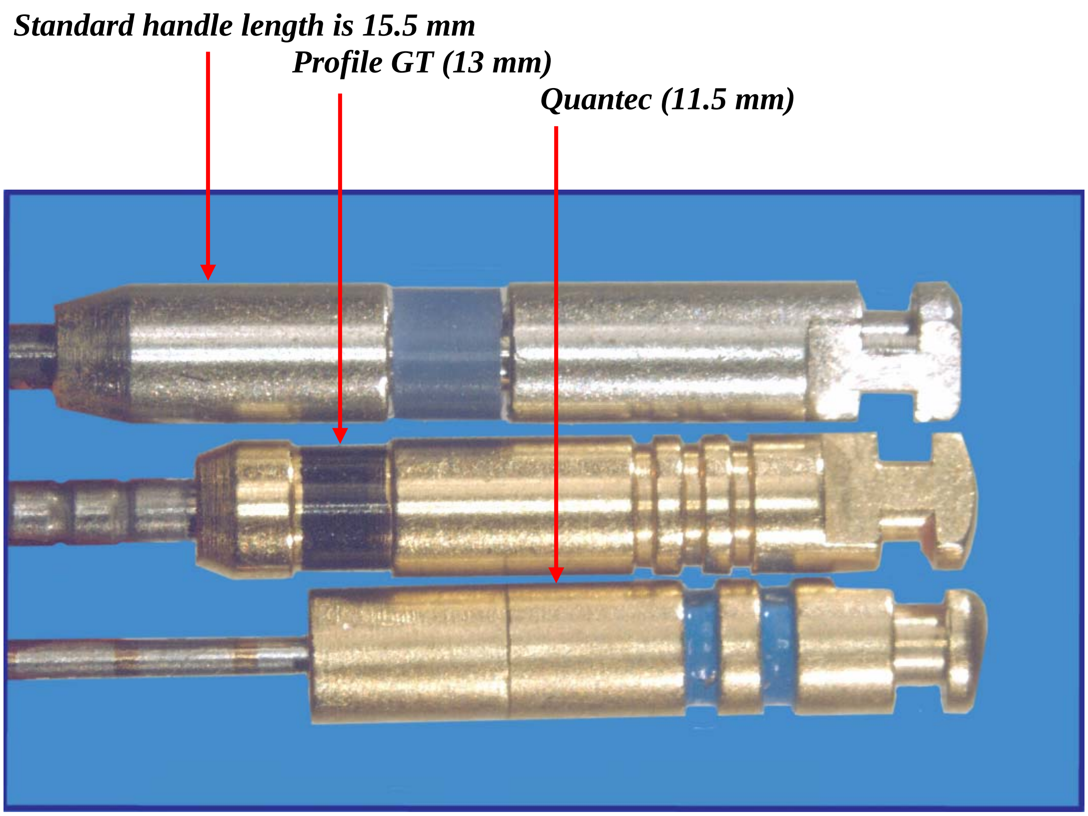
Canal anatomy, file design and file dimensions dictate the appropriate use of an instrument. Often techniques for particular files are the result of subjective concepts recommended for the sake of simplicity, and the capabilities of files become confused with the capabilities of what has inappropriately become their associated recommended technique. How well a file performs while following a specific technique should not be the measure of the effectiveness of a file, rather how well the capabilities of a file can address the requirements of the canal anatomy should be the measure of its usefulness. Since canal anatomies vary, techniques to effectively clean and enlarge the canal may include modifications and may include different type instruments. Instrumentations involving more than one type instrument or technique are known as hybrid techniques.

9. What are the components of a file?

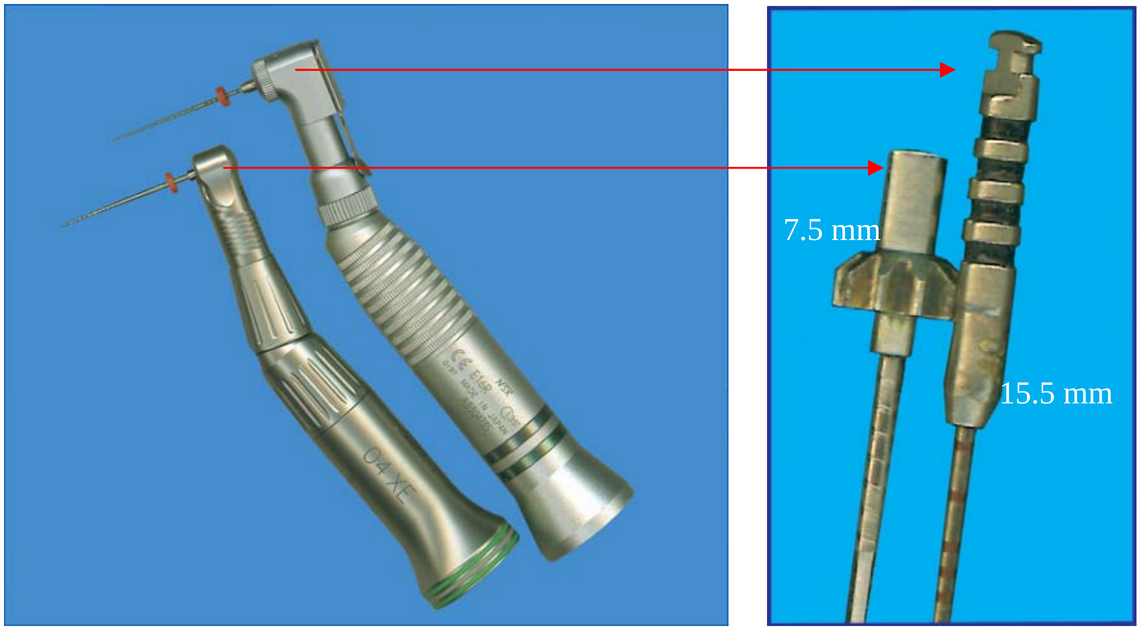


The taper is usually expressed as the amount the file diameter increases each millimeter along its working surface from the tip toward the file handle. For example, a size

25 file with a .02 taper would have a .27 mm diameter 1 mm from the tip, a .29 mm diameter 2 mm from the tip and a .31 mm diameter 3 mm from the tip. Some manufacturers express the taper in terms of percentage in which case the .02 taper becomes a 2% taper. . Historically, as an ISO standard, a file was fluted and tapered at 2% for 16 mm, but now files incorporate a wide variation of lengths and tapers of working surfaces



Access handles can provide greater working space and prevent undue stress caused file distortion outside the canal.



***MicroMega** has used the unique approach of combining the pinion gear of the hand-piece and the handle of the file to increase access. The result is a handle that is 7.25 mm in length or less than one half the length of a standard handle.*

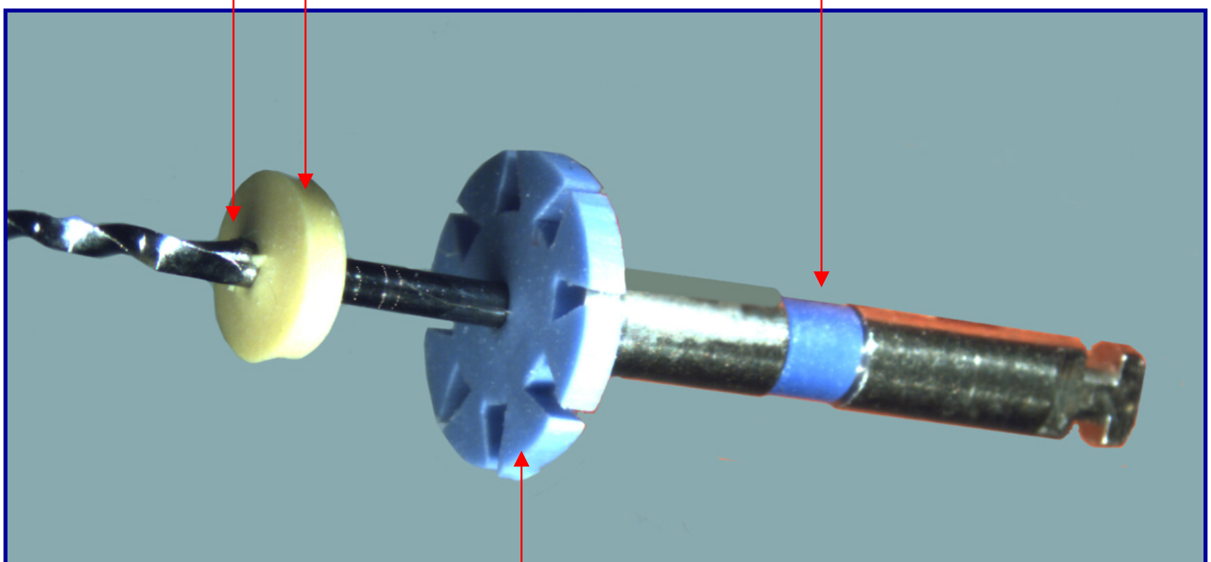
Standardized dimensions played an important role at the time they were instituted for providing the needed consistency for hand instruments but were soon seen as limitations for rotary instrumentation. As different dimensions of rotary files are introduced, the complexities of identification cause confusion. Hopefully, the common components of rotary files can eventually have standardized identifications for easier recognition.

Size and Taper Indicators

Standard fluted surface is 16 mm (rotary files may vary from tip to handle end)

Stop may indicate size or taper (.04 taper shown here)

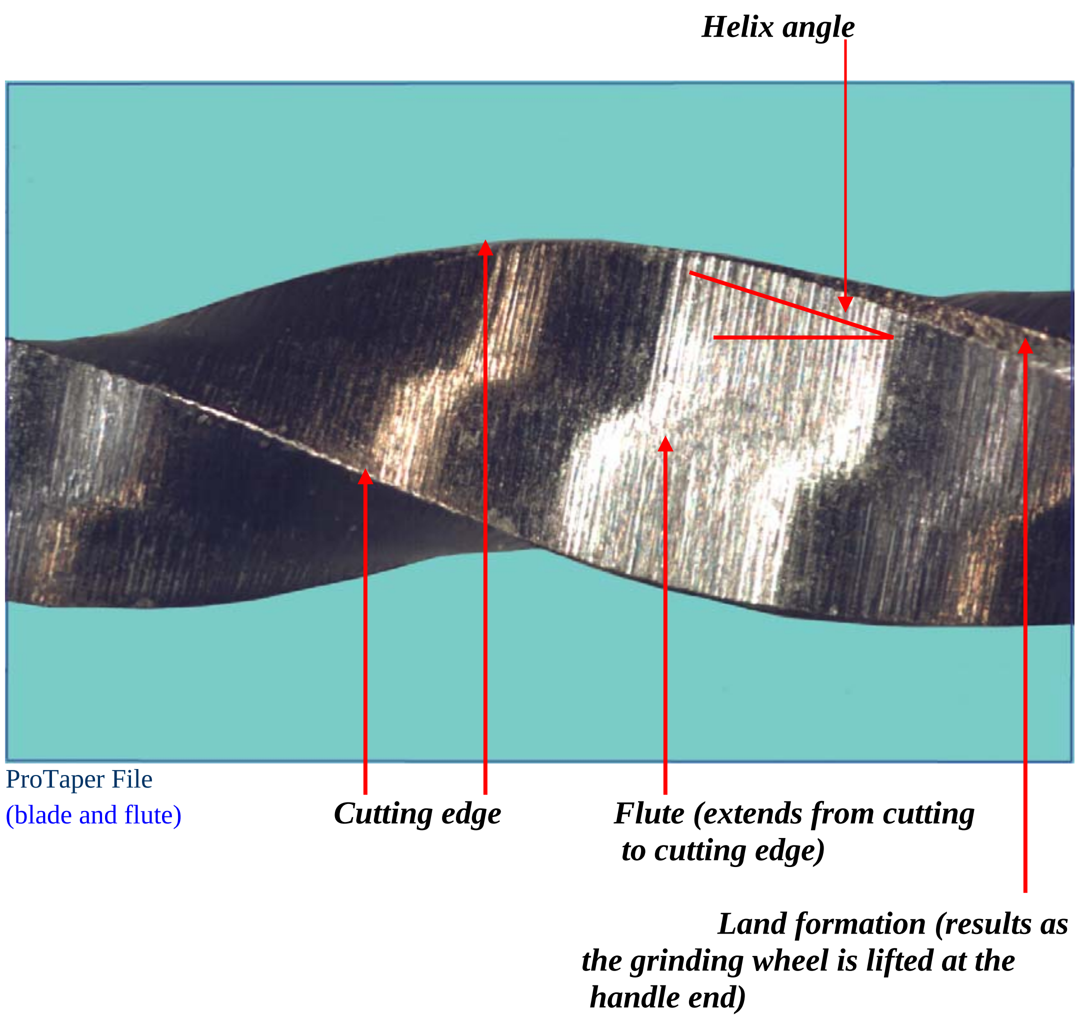
Colored bands can indicate size and taper (size 30 indicated by the blue band)



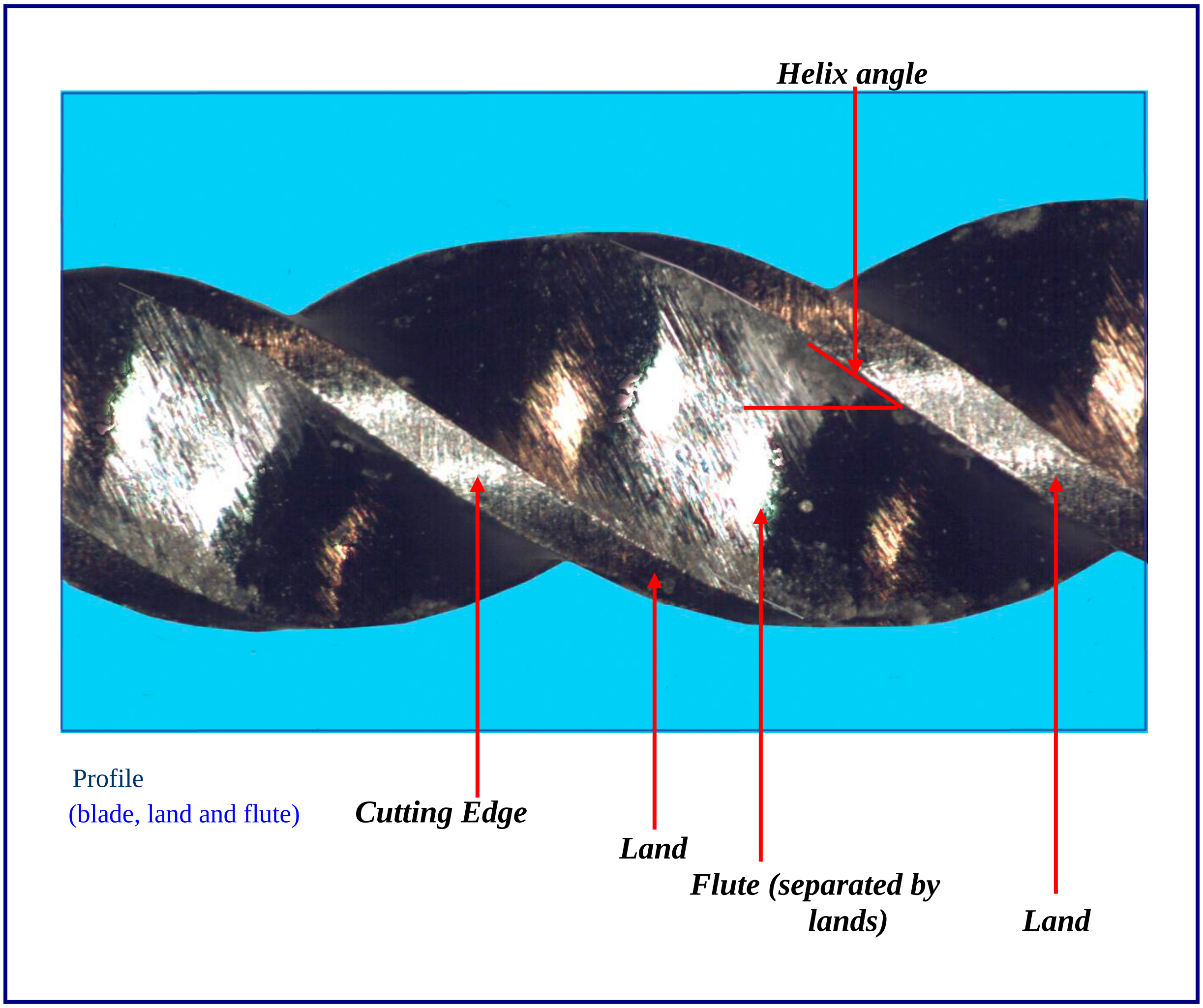
RaCe file

The Memo Disc can keep tract of the number of times the file has been used by removing petals and its color can indicate the file size.

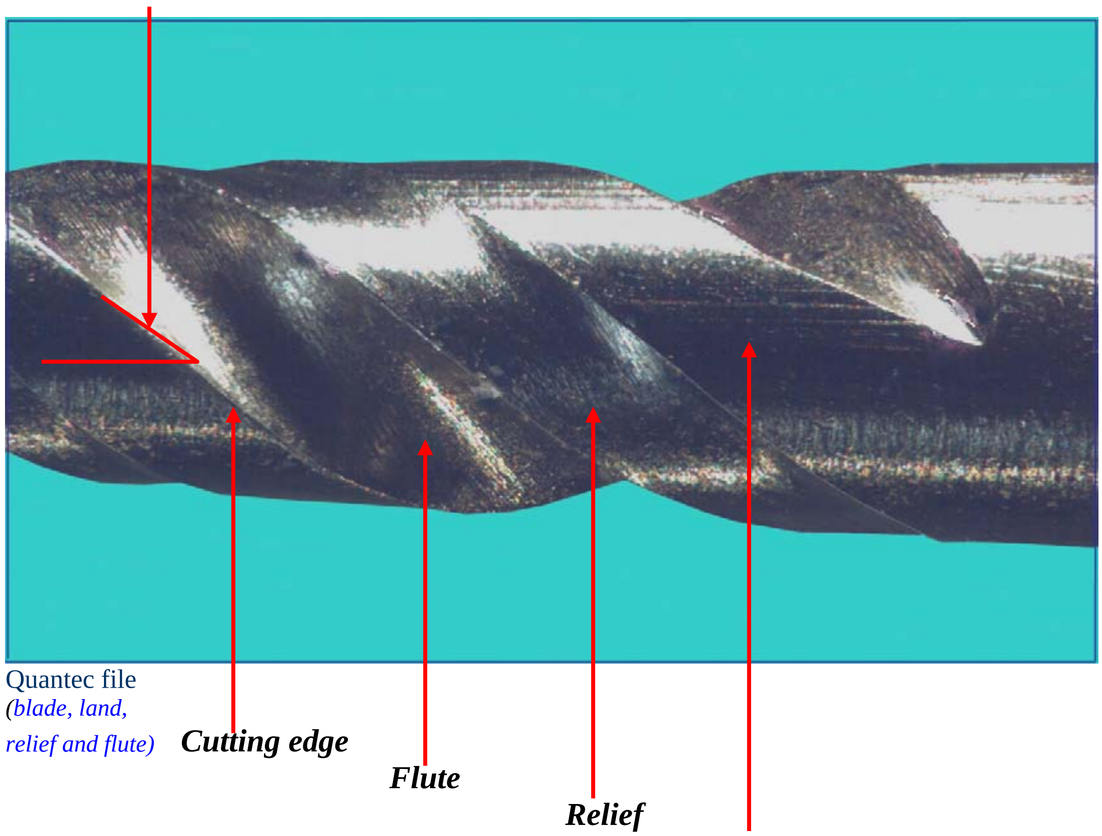
The ***flute*** of the file is the groove in the working surface used to collect soft tissue and dentine chips removed from the wall of the canal. The effectiveness of the flute depends on its depth, width, configuration and surface finish. The surface having the greatest diameter that follows the groove (where the flute and land intersect) as it rotates forms the ***leading*** (***cutting) edge*** or the blade of the file that forms and deflects chips from the wall of the canal and severs or snags soft tissue. Its effectiveness depends on its angle of incidence and sharpness. If there is a surface that projects axially from the central axis as far as the cutting edge between flutes this surface is called the ***land*** *(sometimes called the marginal width).* The land reduces the tendency of the file for screwing into the canal, reduces transportation of the canal, reduces the propagation of micro-cracks on its circumference, gives support to the cutting edge and limits the depth of cut. Its position relative to the opposing cutting edge and its width determine its effectiveness. In order to reduce frictional resistance some of the surface area of the land that rotates against the canal wall may be reduced to form the ***relief***. The angle that the cutting edge makes with the long axis of the file is called the ***helix angle*** and serves to auger debris collected in the flute from the canal. This angle is important for determining which file technique to use.



ProTaper File
(blade and flute)



Profile
(blade, land and flute)



Quantec file
(blade, land, relief and flute)