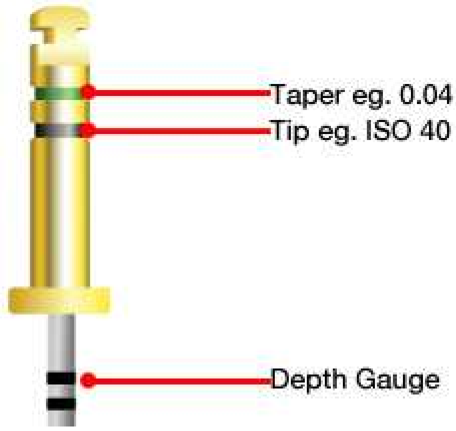
K3 Nickel-Titanium Files

Overview

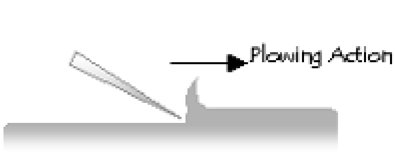
Engineered For Efficiency

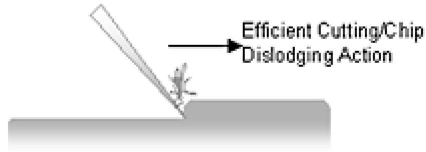
- Positive rake angle provides the active cutting action of the K3.
- Wide radial land provides blade support while adding peripheral strength to resist torsional and rotary stresses.
- The third radial land stabilizes and keeps the instrument centered in the canal and minimizes “over engagement.”
- Radial land relief reduces friction on the canal wall.

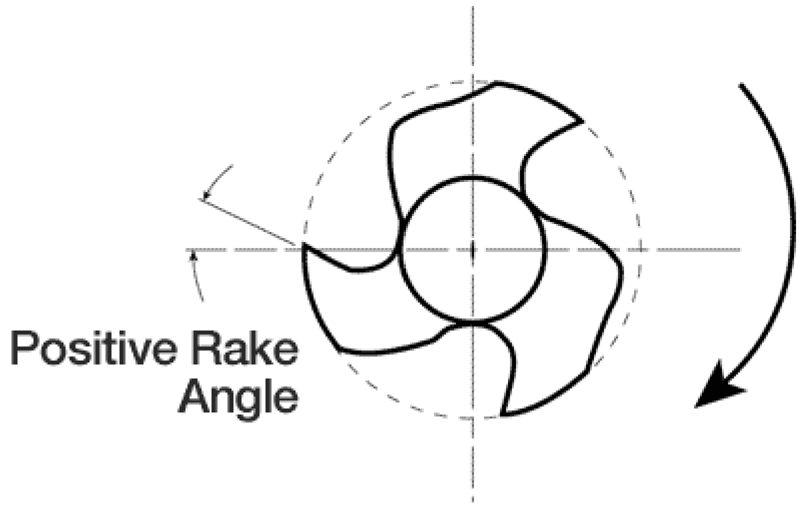
1. Positive Rake Angle
2. Variable Helical Flute Angle
3. Wide Radial Land
4. Surface Reduction
5. Access Handle
6. Third Radial Land
7. Variable Core Diameter
8. Simplified Colour Coding
9. Safe-Ended Tip



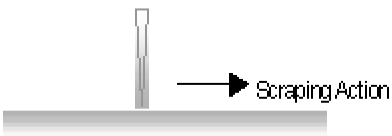
1. Positive Rake Angle An instrument’s cutting efficiency is dependant upon the overall rake angle of the instrument’s cutting blades. Rake angles are determined by drawing a centerline parallel to the center of the file and determining the angle relative to the centerline. It can also be measured relative the circumference as indicated by the green lines on the examples below.

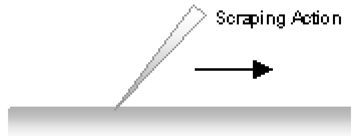


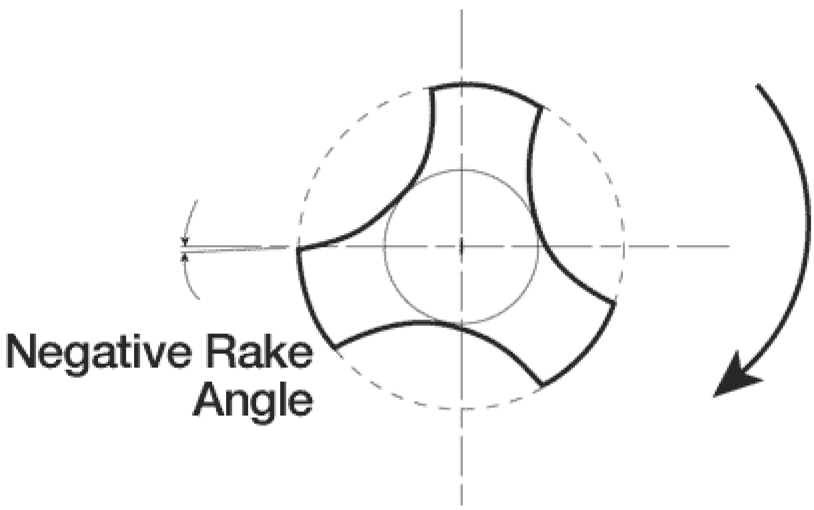




The Profile and most other conventional instruments utilize negative rake angles, which result in a scraping rather than a cutting action. As dentin is dense and somewhat resilient, cutting or chip dislodgment with negative rake angles is difficult and very inefficient.







Variable Helical Flute Angle

As previously noted, negative rake angles are inefficient and result in dentin scraping rather than cutting and chip dislodgment. The ideal rake angle is slightly positive, because an overly positive rake angle will result in digging and plowing of the dentin. The K3 features a slightly positive rake angle for optimum cutting efficiently. The chips resulting from the K3 cutting action are easily dislodged from the working area and carried off via the file's unique helical angle as outlined in the next section.

2. Variable Helical Flute Angle

Once the instrument has made its cut into the dentin, the debris needs to move out of the way. This allows for additional debris removal and channeling to occur in the flute space. Compression occurs when debris is caught between the canal wall and instrument flute. Remember that as the file is working, more debris is built-up in the coronal area of the instrument. If there is no more space to channel debris, the instrument becomes clogged and the debris does not flow out of the canal. The chips resulting from the K3 cutting action are easily dislodged from the working area and carried off via the file's unique variable flute design. In short, the degree of taper increases from the tip to the handle.

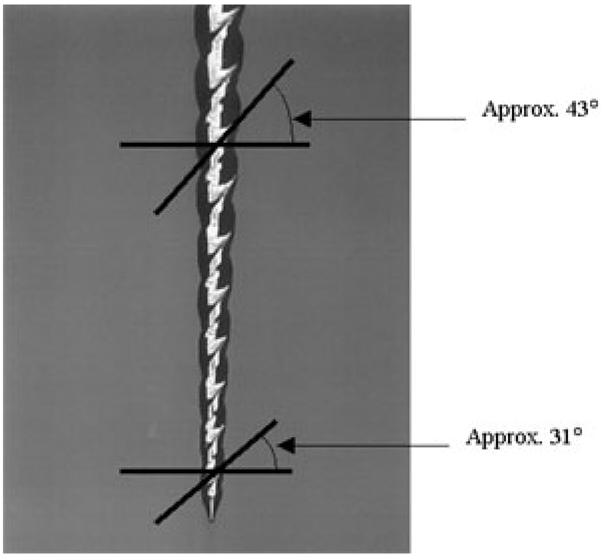
The benefit to the practitioner with K3 is an instrument with unparalleled debris removal.

3. Wide Radial Land

The best way to explain this is blade support. Most file designs derive their strength from the mass of the material encompassed in the core area/diameter of the instrument rather than the core and peripheral area near the blades (radial lands). Therefore a file should have adequate peripheral strength to resist torsional or rotary stresses.

Blade support is defined as the amount of material supporting the cutting blades of the instrument. This part of the file is also called the radial land. This design feature is critical to the instrument. The less blade support (the amount of metal behind the cutting edge) the less resistant the instrument is to torsional or rotary stresses. The Profile for example does not maximize peripheral mass.

Figure 11 - Variable Helical Flute Angle



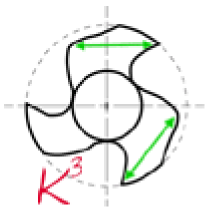


Figure 12: Increased Radial Land

Increased radial land of the K3 increases peripheral strength behind the cutting blade

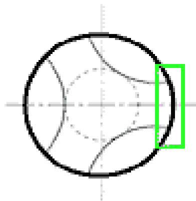


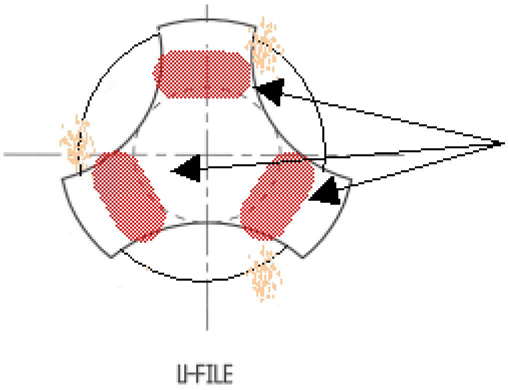
Figure 13: Profile Radial Land

Smaller radial land equals decreased strength for the Profile

Superior peripheral strength is achieved in the K3 by adding more mass behind the cutting blade. To reduce friction, the K3 also has a shallower radial land. The increase in the K3's peripheral mass prevents the propagation of cracks and reduces the chances of separations and deformation from torsional stresses.

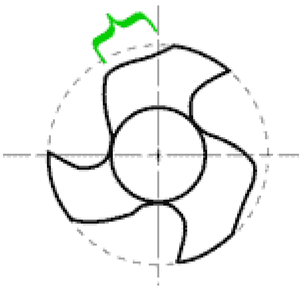
When the blade engages on an instrument with a smaller radial land there are stresses that often lead to instrument failure.

Figure 14: Stresses due to blade engagement

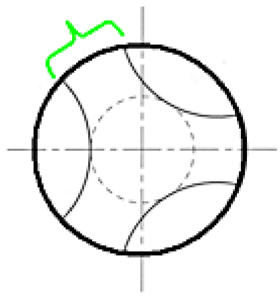


4. Radial Land Relief

The frictional resistance of the file is proportional to the amount of area that the radial land comes in contact with or engages the canal wall. A wide radial land without relief would cause more friction on the canal wall (Figure 16). Figure 15 graphically demonstrates the significantly more sophisticated engineering and design of the K3.



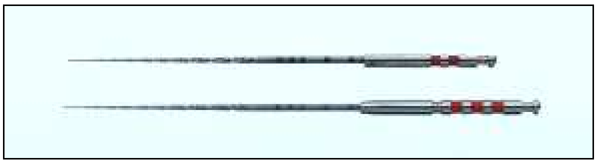
Peripheral Blade Relief to reduce friction and facilitate smoother operation



The K3 Blade Relief areas, in addition to reducing frictional resistance also play another role. Many files have no means to control the depth at which the flutes engage the dentin. The harder one pushes apically, the deeper the blades will engage the canal walls. The K3 peripheral blade reliefs help to control the depth of cut. This aids in protecting the file from over-engagement, and separations (breakage). U-shaped files without such a relief have a greater potential for over-engagement, apical blocking and instrument failure.

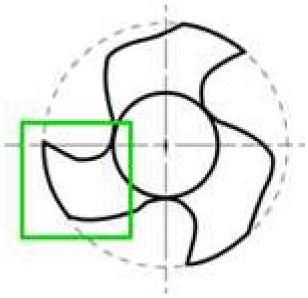
5. Access Handle

In the field of endodontics, the three most important things are ACCESS, ACCESS, and ACCESS. The K3 Access handle allows the operator easier access to the posterior region of the mouth. The K3 files are 4mm shorter than their competitors, yet the working (fluted) length is the same. In addition to the shorter overall length of the instrument, the operator can see much easier than with the standard size endodontic handpieces currently available.



The primary purpose of the Third Radial Land is to prevent the file from "screwing" itself into the canal. This flute, without the relief allows the operator much more control of the instrument and also prevents over-flaring the canal by centering and stabilizing the instrument.

Figure 17: Third Radial Land



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7. Variable Core Diameter

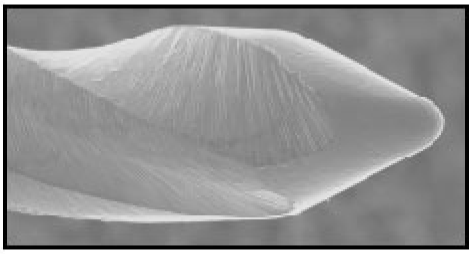
This may actually be better described as variable flute depth. The proportion of the core diameter to the outside diameter is greatest at the tip, where strength is most important. This proportion then decreases uniformly as the fluting moves up the taper, resulting in greater flute depth and increased flexibility while maintaining strength. An additional benefit to this is that debris is also removed more efficiently.

8. Simplified Colour Coding

K3 is a simple system in that it only has two tapers; 04 and 06. 04 is Green, and the 06 tapers are Orange. The instruments will have two colour bands on the handle. The top band signifies the taper, and the bottom band (closest to the business end) conforms to standard ISO sizing. There are 10 sizes, and they are all measured at the tip. Please see the last page of the brochure for part numbers and colour codes.

9. Safe-Ended Tip

The safe-ended non-cutting tip of the K3 instrument follows the canal system of the tooth extremely well and assists the practitioner in avoiding ledging, perforations, zipping and other nasty surprises.



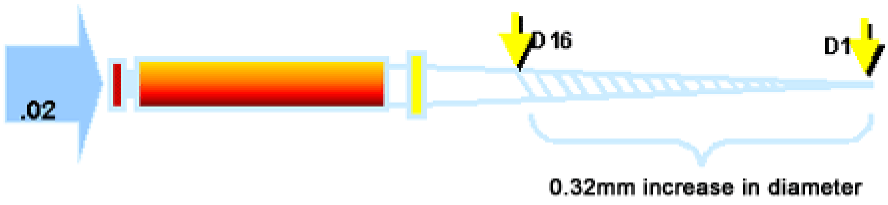
The introduction of Rotary Nickel Titanium (Ni-Ti) instrumentation has revolutionized the field of endodontics. For over 5 years, the endodontic community has accepted these tools as the new standard, thereby displacing the relevancy of standard ISO stainless steel instruments in the endodontic procedure.

The pioneers of Ni-Ti instrumentation include Drs. John MacSpadden and Ben Johnson. Both introduced the concept of manufacturing and utilizing Ni-Ti instruments of a greater taper compared to conventional ISO tapers (0.02 tapers). The greater tapered instruments utilize tapers from 0.04 up to 0.12. The advantages of these greater tapered instruments are as follows:

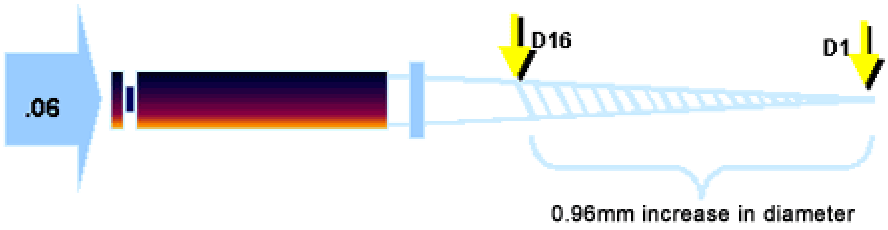
- More efficient preparation
- Engine driven; no more sore fingers
- Fewer instruments used for the preparation
- Superior preparation to facilitate better obturation

Figure 1: Definition of Taper

The diameter of the instrument below increases 0.02mm for every millimeter of length from D_1 to D_{16} on ISO or standard tapered.



The diameter of the greater tapered instrument below increases 0.06mm for every millimeter of length from D_1 to D_{16}.



In addition, the uncanny flexibility of Ni-Ti allows these greater tapered files to retail flexibility to negotiate through even the most curved canals. A greater tapered stainless steel instrument would be very stiff and inappropriate for use in curved canals.

The introduction of sophisticated computer modeling and multi-axis CNC grinding machines has allowed manufacturers to push the boundaries of instrument design and development. With the clinical acceptance of Ni-Ti instruments throughout the endodontic community, it is only natural and logical for general dentists to also begin accepting these instruments as the standard for endodontic procedures. A worldwide survey indicates that the general dentist performs approximately 89% of all endodontic procedures. Therefore the need to compete and provide the best Ni-Ti solutions for both general dentists and endodontic specialists are paramount for the future success of any manufacturer.