Fact File

ProTaper Ultimate™ Endodontic File System

ProTaper Ultimate™ is a root canal treatment solution combining

- the latest generation of ProTaper NiTi files designed to create a Deep Shape,
- an enhanced disinfection concept with irrigation needles and
- a dedicated obturation system supplemented by the new bioceramic sealer AH plus BS.

ProTaper Ultimate™ File System and the Deep Shape Concept

Successful endodontic therapy requires cleaning, shaping and obturation of the root canal (1). The necessary mechanical preparation of the canal generates debris and a smear layer (2), that can compromise the seal of the root canal filling. The removal of the debris and the smear layer by irrigation is less predictable in the apical part than in the coronal part of the canal (3) and can be significantly influenced by the shape of the apical canal (2). With ProTaper™ Dentsply Sirona introduced the unique concept of Deep Shape (increased apical taper) to the market. Consequently, the Deep Shape philosophy also became an inherent part of the new ProTaper Ultimate™ file system and is obtained by the combination of specially designed files (figure 1).

The ProTaper Ultimate™ rotary file system consists of a slider, a shaper and finishers (F1-F3, FX, FXL). The slider is used to create a reproducible pathway to the apical/canal terminus and paves the way for the Shaper. The Shaper enhances cutting efficiency and hauling of debris in the coronal two-thirds providing easy and safe access to the apical third by the Finishers. The Finisher finally creates the ProTaper Ultimate™ Deep Shape. All files work at the same recommended motor speed of 400 rpm, and at the same torque range of 4 – 5.2 Ncm and are also available as identical hand-file versions.

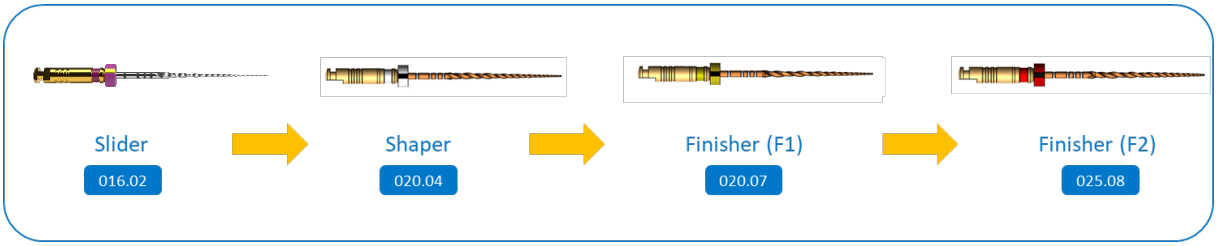

Figure 1: Main sequence for most anatomies (6). The assortment is completed by one Orifice opener (SX), a Finisher (F3) and two auxillary Finishers (FX, FXL), numbers below the instruments provide the size and the taper.

To maintain the original ProTaper philosophy of Deep Shape, the Finisher files have an apical preparation size with a taper of at least 7% (F1: 7%, F2: 8%, F3: 9%). The F2 Finisher file for example creates a 19% higher apical volume compared to comparable ISO files (4). Studies show that the ProTaper™ Deep Shape leads to optimized hydraulics of the disinfection fluid (4) and better evacuation of the debris, preparing the canal for a better fill with better seal and less apical extrusion, while preserving the upper canal portion thanks to the multiple taper design.

In a user study with 21 dentists, who treated 210 canals with the ProTaper Ultimate™ file sequence, 95% stated that they achieved a sufficient “Deep Shape” for a sufficient disinfection and 85% of the participants agreed that ProTaper Ultimate™ showed a sufficient debris evacuation (7).

ProTaper Ultimate™ File System - Mechanical Data

Based on a series of new patent-protected instrument geometry features and the application of different heat treatments, ProTaper Ultimate™ shows higher flexibility, higher unwinding resistance and higher cyclic fatigue resistance compared to ProTaper Gold™ and other comparable files on the market (5; 6). In comparison to ProTaper Gold™, ProTaper Ultimate™ F1 showed 13% higher flexibility and 75% higher cyclic fatigue and ProTaper Ultimate™ F2 showed 30% higher flexibility and 30% higher cyclic fatigue resistance (5).

When forcing different instruments into "S"-shaped canals, ProTaper Ultimate™ was able to treat a significantly higher number of root canals before showing signs of unwinding (figure 2); and showed the fastest canal preparation compared to other files already on the market (figure 3).

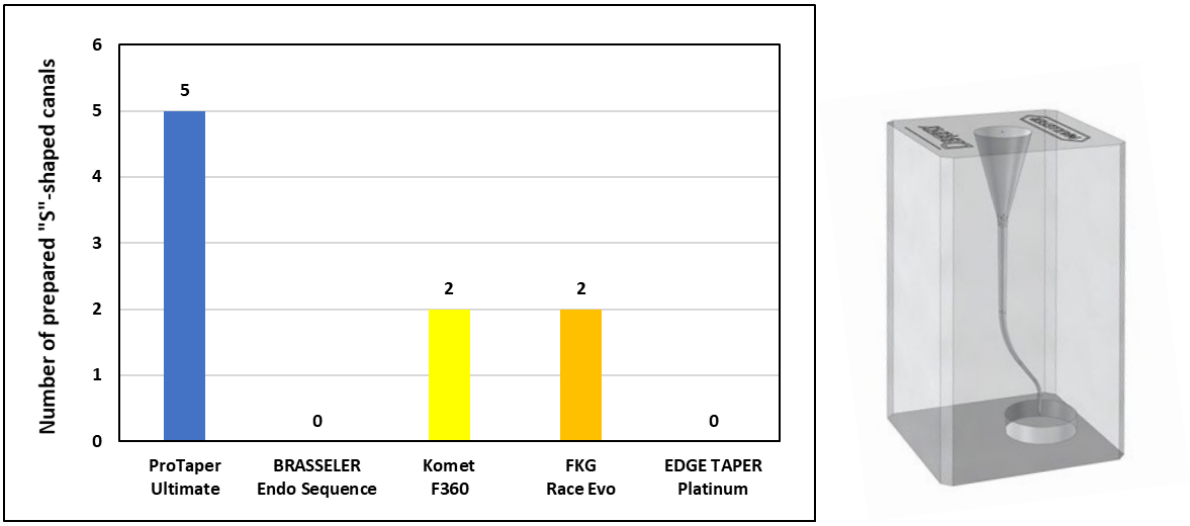

Figure 2: Number of "S"- shaped canals (picture on the right) treated before unwinding could be detected by visual inspection. ProTaper Ultimate™ shows higher unwinding resistance compared to all competitor files, n=5 per group (6). Brasseler EndoSequence CM Taper Files, Komet F360, FKG Race Evo, Edge Taper Platinum are not registered trademarks from Dentsply Sirona.

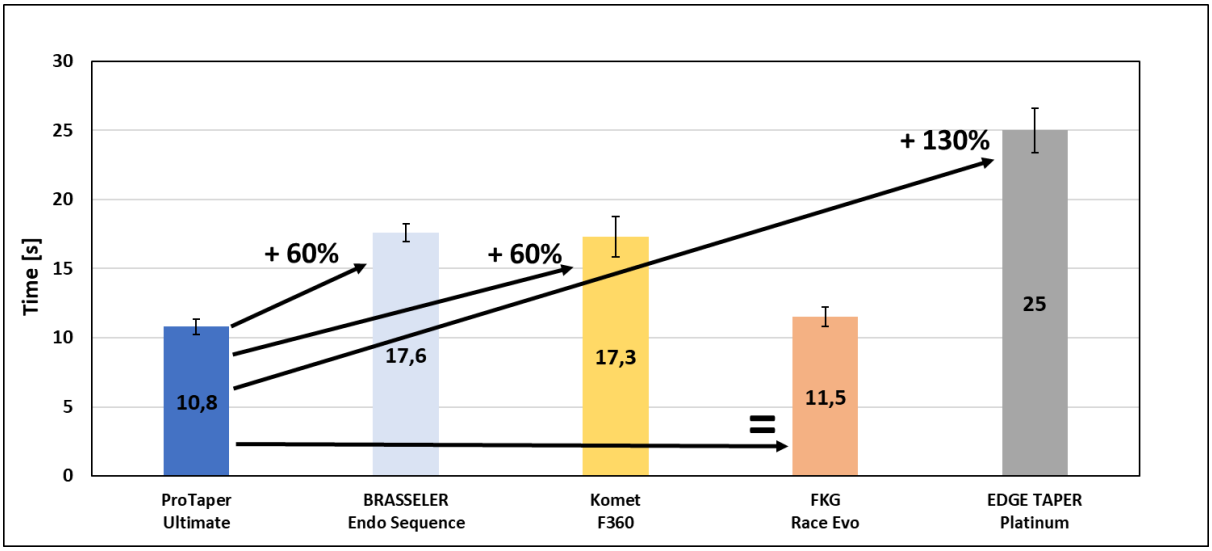

Figure 3: Time required to prepare a "S"-shaped canal to an apex size of 0.25 mm (5). Brasseler EndoSequence CM Taper Files, Komet F360, FKG Race Evo, Edge Taper Platinum are not registered trademarks from Dentsply Sirona (n=5 per group).

Fatigue strength of the ProTaper Ultimate™ files was also tested using a tempered stainless-steel set-up simulating a canal with a 90° angle and a radius of curvature of 3 mm. They all exhibit a high fatigue resistance, with life expectancies from 30 % to 550 % higher than the other comparable files on the market (Figure 4) (5).

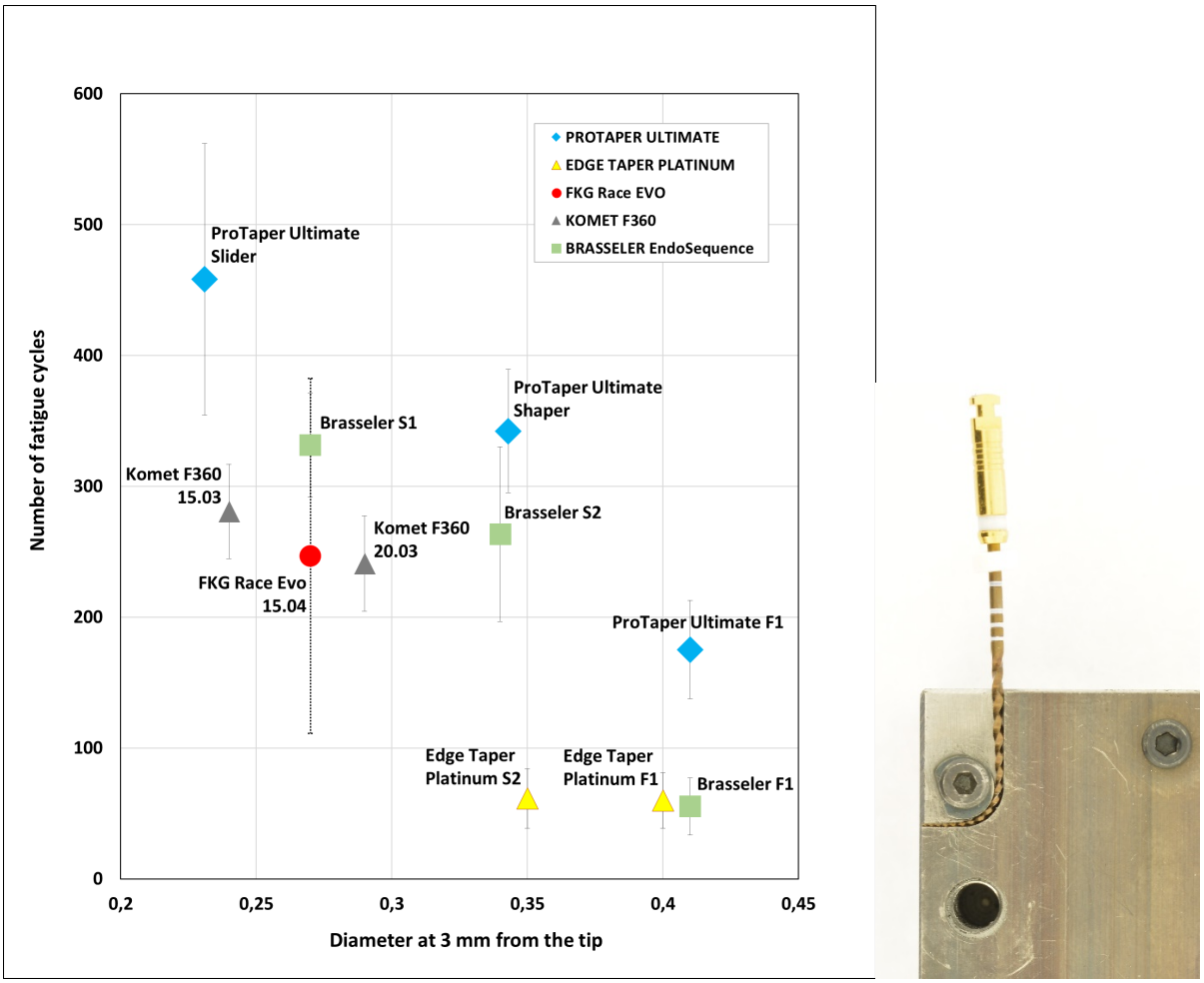

Figure 4: Fatigue resistance of ProTaper Ultimate™ files and competitor files in a 90° angle (3 mm radius of curvature) (left) and image of the fatigue testing set-up (right). Brasseler EndoSequence CM Taper Files, Komet F360, FKG Race Evo, Edge Taper Platinum are not registered trademarks from Dentsply Sirona.

ProTaper Ultimate™ File System - Design Features

A specific parallelogram cross section geometry with variable acute angles at different lengths of the instrument was applied on all files (figure 5). This allowed to specifically adjust the cutting efficiency of each part of the file depending on the expected workload in certain areas during operation. Additionally, this positively influences the flexibility and unwinding resistance of the files.

By using specific alternating off-set machining manufacturing process, the files possess a geometry in which the center of mass of the instrument is not aligned with the center of rotation. This reduces the stress level during cutting and increases the available space for debris removal.

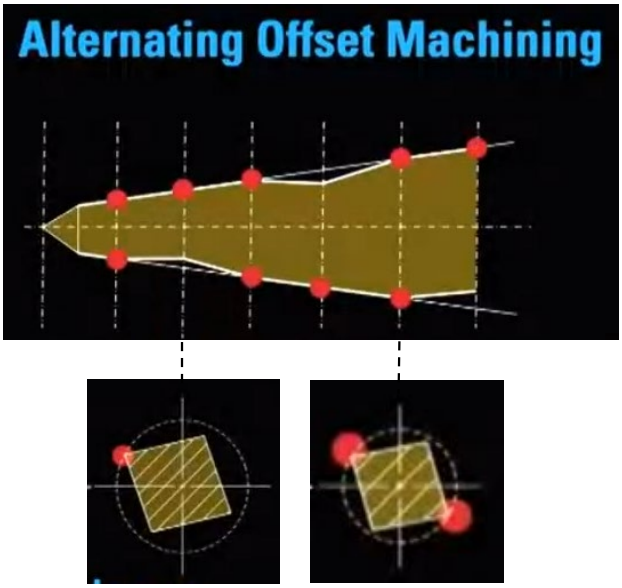

Figure 5: Parallelogram cross section of the ProTaper Ultimate™ files. Variable acute angles are applied at different lengths of the file. The off-centered geometry in certain parts of the file was achieved by alternated offset machining.

The Slider file is made of NiTi which received a pre-thermal treatment during wire production (M-wire-technology). This allows a certain rigidity of the file to be able to secure the pathway of the canal and to be able to remove restriction dentin and other calcifications without the systematic need of a K-File. In a user study with 21 dentists, who treated 210 canals, 95% stated that the ProTaper Ultimate™ Slider provides a smooth reproducible pathway to the apical terminus, without the need of a K-file in 63 % of the cases (7).

The Shaper and Finisher files received a post-grinding heat-treatment to account for a proper negotiation of the canal curvature without transportation and without unwinding issues. The Shaper and the Finishers F1-F3 received a so called “Gold heat-treatment” and the auxiliary Finishers FX and FXL received a so called “Blue heat-treatment”. In the same user evaluation as mentioned above, 85% to 90% of the dentists agreed that ProTaper Ultimate™ has a sufficient flexibility and unwinding resistance (7).

In conclusion, the ProTaper Ultimate™ file system showed higher fatigue strength in canals with a 90° angle, and a higher performance with the fastest treatment time and highest unwinding resistance, compared to ProTaper Gold™ and other files on the market.

References:

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