

Laboratory Evaluation of Procodile Q Endodontic Files

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Introduction:

This study evaluated the cyclic fatigue resistance and cutting efficiency of 2 types of reciprocating files, the new **Procodile Q** from Komet® and **WaveOne Gold** from Dentsply Sirona. The heat-treated **Procodile Q** features a variable tapered core for increased flexibility toward the shank while the cutting edges are uniformly tapered for a uniform canal excavation. The cutting edges feature a double S curve for improved evacuation of debris while cutting.

A **Promark Endo Motor** (Dentsply Sirona) was used with the **WaveOne** setting (170° CCW cutting, 50° CW motion) for tested file sizes 020, 025, 035. The cyclic fatigue test using the DENTAL ADVISOR Cyclic Fatigue Platform featuring a 80° and 5 mm radius was conducted until file failure. Cutting efficiency and durability was assessed using plastic blocs with canals instrumented in sequence with 3 canals per file, until unwinding or file damage occurred, with the time to instrument each canal measured.

Conclusion:

Procodile Q files lasted between 197 % and 325% longer in the cyclic fatigue test than **WaveOne Gold**. **Procodile Q** files also instrumented the training blocs about 16% faster overall with less file damage detected, and with more debris removed coronally.

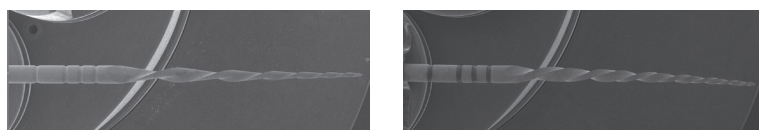
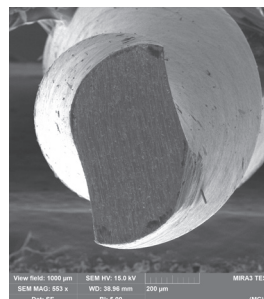


Fig 2. Full Length views of **Procodile Q** and **Wave One Gold** #025 primary files.

Procodile Q



WaveOne Gold

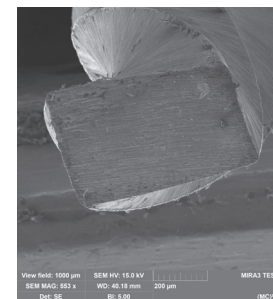


Fig 1. Cross-sectional views of #035 medium files. **Procodile Q** files feature a more acute cutting angle with a ~106° cutting edge. **WaveOne Gold** files feature a parallelogram design with ~85° cutting edge resulting in more of a scraping mode of instrumentation.

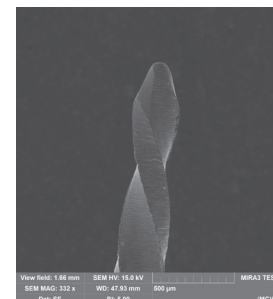
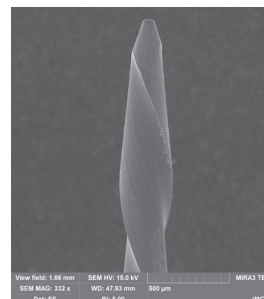
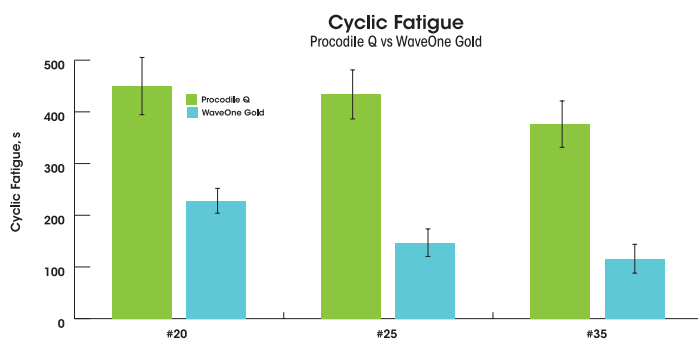


Fig 3. Magnified views of tip design

Tests:

Cyclic Fatigue Resistance (n=10): 10 files of 3 different sizes were tested as received. Canals precision milled into hardened stainless steel with 5 mm radius and 80° angle in the DENTAL ADVISOR Cyclic Fatigue Platform was used using the **WaveOne Gold** setting for all files without irrigation. Time until fracture was recorded, and means with standard deviations reported in the results.



Cyclic Fatigue Resistance Summary: **Procodile Q** files lasted between 197 % and 325% longer in the cyclic fatigue test than **WaveOne Gold**. The combination of the heat treatment, lack of surface defects and variably tapered core likely contributes to higher cyclic fatigue resistance for **Procodile Q** files.

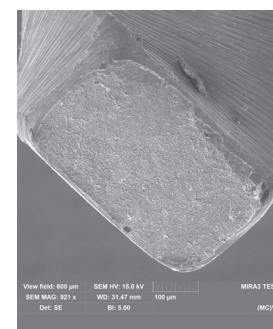
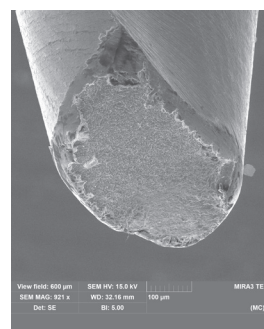
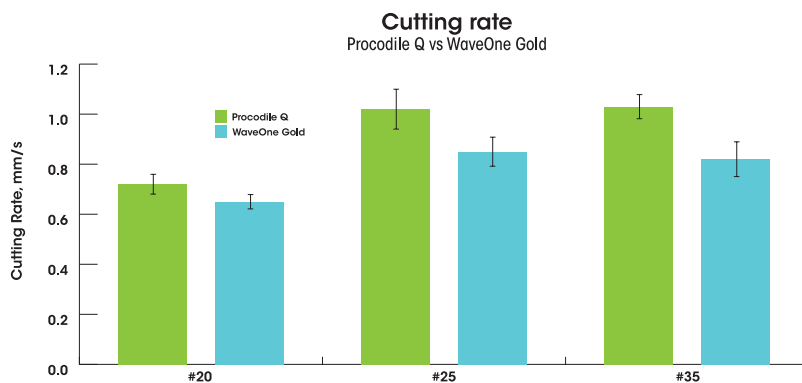


Fig 4. Size 025 Primary files after cyclic failure. Note the smoother surface and difference in core texture versus of the **Procodile Q** (left).

Cutting Efficiency and Durability (n=5): After practice and familiarization with the materials, canals were instrumented root canals of Endo-Training-Bloc (Ref: A0177, Dentsply Sirona) with light water irrigation to remove excess debris using a light pecking motion when resistance was felt. The working time to reach the apex was measured for each instrument in sequence and the sum of the working times for each file used was calculated for #020 to #035 files. The cutting rate was calculated by dividing the working time by the working length (10 mm) to the apex. Three canals were instrumented in sequence by each set of files. Microscopic evaluation under 40x magnification next to new files were conducted before continuing to detect the presence of unwinding.



Cutting Efficiency and Durability Summary: Overall cutting rate for **Procodile Q** was 16% faster than **WaveOne Gold** with full sequence instrumenting taking an average of 33.5s for Procodile Q to 39.5s for **WaveOne Gold**. All Files survived past 2 canals. Detectable unwinding was detected after the 3 canal instrumented with **WaveOne Gold** in three #020, three #025, and one #035 **WaveOne Gold** files, and in only two #035 **Procodile Q** files.

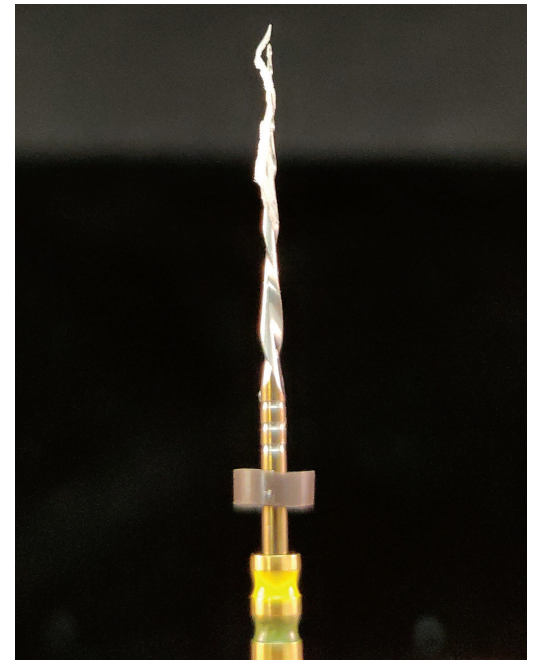


Fig 5. **Procodile Q** removes a large amount of debris after use.

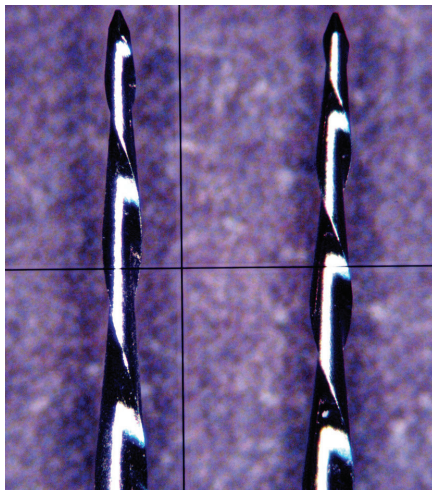


Fig 6. Procodile Q 035 File with slight unwinding after 3rd canal (unused file on right for comparison)

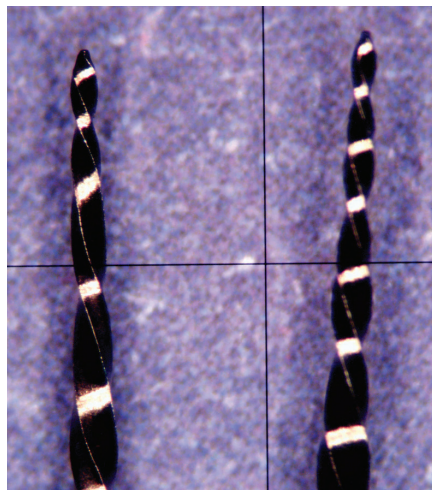


Fig 7. Wave One Gold File 025 with unwinding after 3rd canal

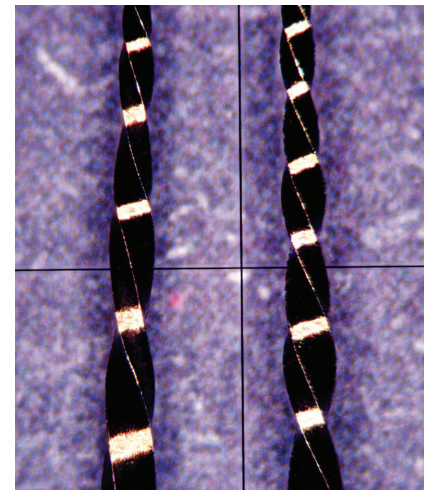


Fig 8. Wave One Gold 020 File with unwinding after 3rd canal