



# Wear evaluation of innovative HyFlex EDM after clinical uses: preliminary results



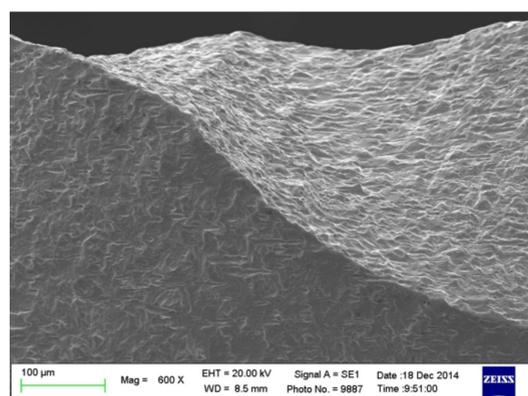
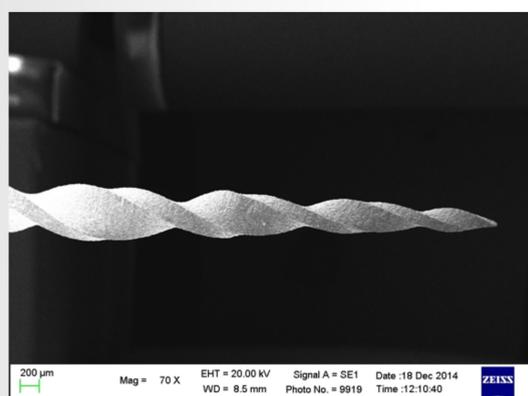
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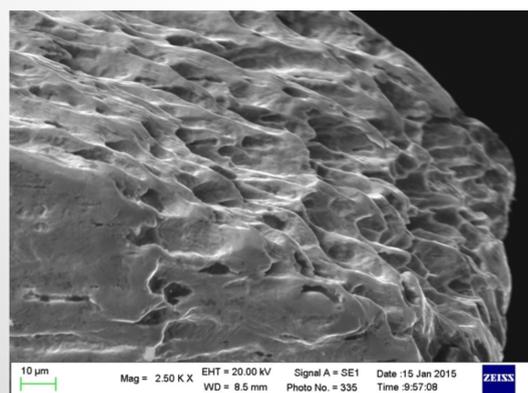
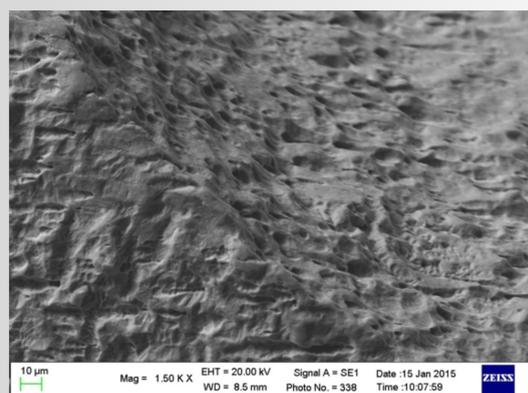
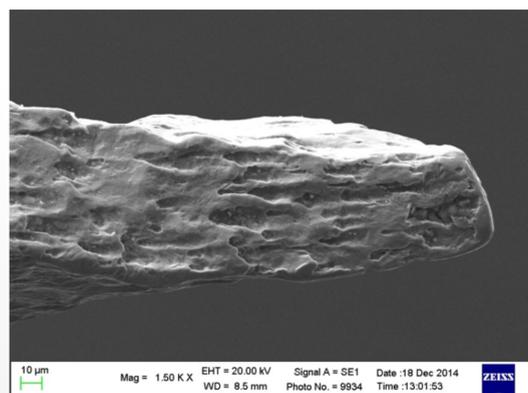
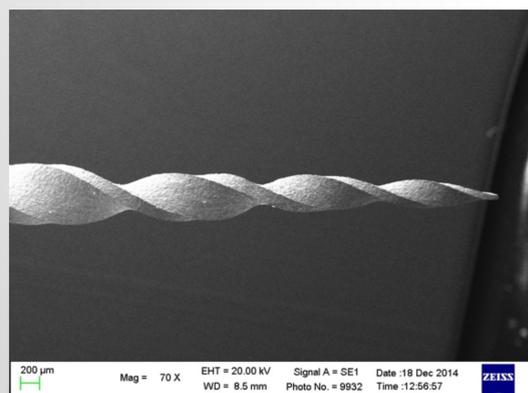
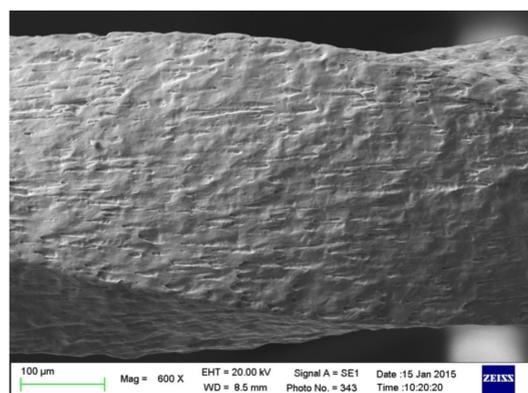
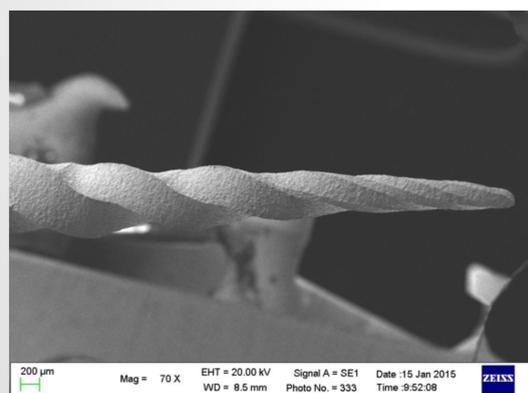
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**Aim** Recently patented treatments are involved in the manufacturing of the innovative HyFlex EDM files (Coltene/Whaledent, Switzerland). The main feature of these files is that they are manufactured via electro discharge machining (EDM) process, a spark erosion method that erodes the workpiece by high-frequency spark discharges. Aim of this study was to examine, under ESEM/EDS, the impact of their clinical use on the superficial characteristics.

**Methodology** Curved canals of multi-rooted teeth were selected on the strength of their anatomy and endodontically treated by a single-trained-operator. Canal patency was verified with a manual K-file #10. The used operative rotating sequence was: 25/12 at 2/3 of the WL, and 25/08 at WL at 500 rpm and 2.5 Ncm. Five sequences of HyFlex EDM (Coltene/Whaledent, Switzerland) were used to instrument 10 canals each. Irrigation was provided with 5% NaOCl and 10% EDTA (Ogna, Muggiò, Italy). The endodontic procedures were verified and confirmed with intra-operative and post-operative periapical radiographs. HyFlex EDM files were autoclaved after each treatment and discarded after 10 canals. The ESEM/EDS analysis was conducted postoperatively at increasing magnification, from 70X to 5000X, on the tip and on cutting edges at 5 mm from the tip, to detect surface characteristics and to identify the wear features. The wear degradation was evaluated in order to verify the appearance of fractures, unwinding, microcracks, blade disruption and tip deformation.



Representative ESEM micrographs at different magnifications (70x, 600x) of a new 25.08 EDM files. A "craters-like" surface is the typical superficial morphology of the ED-machined materials.



HyFlex EDM at different magnifications after 10 canals instrumentation. Micrographs showed the absence of deformations or spirals unwinding. Micrographs at higher magnification (from 600x to 2500x) revealed the preservation of the "craters-like" surface and no blade disruption and microcracks in the tip portion.

**Results** No instruments fractured and no macroscopic signs of deformation were reported. Files 25.08 and 25.12 remained intact, never reporting plastic deformations, spiral unwinding or microscopic signs of wear. Considering the significant increase of diameter and taper, and the high stress the files were subjected to, the absence of degradation was remarkable. This finding would confirm the 25.08 instrument as a "one file" while the use of 10.05 and 25.12 can be considered optional. Radiographic evaluation of endodontic treatment demonstrated that the original canal anatomy was respected.



Representative clinical cases performed with HyFlex EDM. All the cases presented curved or calcified canals.

HyFlex EDM	Fractures	Unwinding	Microcracks	Tip deformation	Blade disruption
25.12 (n=5)	0	0	0	0	0
25.08 (n=5)	0	0	0	0	0

Incidence of wear and superficial defects after 10 canals instrumentation.

**Conclusions** No plastic deformations or microscopic signs of wear were reported on severely stressed files. Within the limitations of this preliminary evaluation, the present "one file" technique of HyFlex EDM resulted suitable for shaping multiple curved root canals.

## References

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- Shen Y, Coil JM, Zhou H, Zheng Y, Haapasalo M (2013) HyFlex nickel-titanium rotary instruments after clinical use: metallurgical properties. *International Endodontic Journal* **46**, 720-9.

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