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Methods. Twenty-two upper incisors were selected from a pool of extracted teeth. The teeth had a single round canal with a long-short cross-section diameter ratio $\leq 2,5$ at 8 mm from the apex and similar root canal anatomy. The teeth were randomly divided into two groups in according to the irrigation technique used: self-adjusting file system (SAF) (group 1) and conventional endodontic needle irrigation (group 2). The groups resulted homogeneous according to the canal width. The same operator performed all experimental procedures. The crowns were sectioned at the cemento-enamel junction and the root length was standardized to 13 mm from the apex. The coronal thirds were enlarged with size 1, 2, 3 and 4 Gates-Glidden drill. The working length (WL) was established by the insertion of a 21-mm #10 K-File until its tip appeared at the apical foramen under microscopic vision at 10x. A glide path was performed using size 13, 16 and 19/.02 PathFile at 300 rpm. In the group 1 the 1,5-mm-diameter SAF was operated for four minutes and continuous irrigation with 5,25% NaOCl was performed by a VATEA peristaltic pump at a rate of 4 mL/min. In the group 2 the canals were instrumented using Protaper Universal to a size of the F2 instruments at the working length and irrigated with 1 ml 5% NaOCl at every instrument changes. In both groups a final irrigation of 2.0 mL 1% EDTA for 30s was performed. Roots filling was performed with Guttacore Obturators with TopSeal labeled with 0,1wt% Rhodamin B. Transverse sections at 2, 5 and 7 mm from apical foramen were observed using a confocal laser scanning microscopy. Total percentage and maximum depth of sealer penetration were measured and registered using ImageJ software. Statistical analysis was performed by ANOVA and Turkey test.

Results. The 7-mm and 5-mm sections of group 1 showed a significantly higher percentage and maximum depth of sealer penetration respect the group 2. Not significant difference was found at 2-mm sections between the two groups.

Conclusion. The self-adjusting file cleaning-shaping-irrigation system improved the sealer penetration at coronal and middle sections respect the conventional endodontic needle irrigation. At apical sections no differences were found.

HyFlex EDM rotary Ni-Ti prototypes: the effect of an innovative machining technology on Ni-Ti wear

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Aim. HyFlex EDM files were recently introduced presenting an innovative electro discharge machining (EDM) process of fabrication. The aim of this study was to evaluate the surface and microstructural alterations of new and in vitro used HyFlex EDM Ni-Ti rotary prototypes.

Methods. The surface and microstructural characteristics of 15 new HyFlex EDM instruments were analyzed by ESEM equipped with energy dispersive x-ray spectrophotometry (EDS) and optical metallographic imaging. Instruments were subjected to instrumentation tests on severely curved root canals (ranging between 50° and 70°) of extracted multi-rooted teeth. Once that canal patency was verified with a #10 K-file, the working length was determined by subtracting 1mm. HyFlex EDM files were used with a 16:1 reduction handpiece X-Smart (Dentsply Maillefer, Baillagues, Switzerland) following the manufacture's direction, at 500 rpm and 2.5Ncm, with slightly apical pressure and pecking motion. The operative sequence was: 25/12 at 2/3 of the WL, 10/05 and 25/08 at WL. Irrigation was performed at every change of instrument, with a total amount of 3 ml of 5% NaOCl and 3 ml of 10% EDTA (Ogna, Mugliò, Italy). Each instrument was used in 10 curved canals, washed in an ultrasonic bath containing detergent for 10 min and then autoclaved at 134°C. Surface and microstructural characterizations were repeated on used instruments at same points and with same angulations to compare the pre- and postoperative micrographs, in order to verify the appearance of fractures, unwinding, microcracks, blade disruption and tip deformation.

Results. Surface and microstructural characterization of new instruments revealed the typical features of a NiTi ED-Machined alloy with an irregular and "craters-like" surface. High magnification micrographs disclosed a non-uniform structure where pits, pores and voids caused the peculiar aspect of a "rough-spark-machined" surface. No fractures were registered during instrumentation of curved canals. Surface and microstructural characterization of used files revealed no wear and no degradation of the 25.12 and 25.08 files. The tip segment was confirmed as the most mechanically stressed portion of 10.05 prototypes. All the instruments, after several uses, well-preserved the "craters-like" irregular surface without cutting edge alterations. The metallographic inspection on the cross section of brand new HyFlex EDM files showed a homogeneous martensitic phase. The microstructure appeared uniform from the surface to the bulk, and no microcracks or defect were identified, even at high optical magnification (1000X).

Conclusion. Unaltered spark-machined surface and low microstructural degradation are the main features of recently introduced HyFlex EDM. Caution would be recommended regarding reuse of small HyFlex EDM files. Instruments exhibited a safe in vitro use in presence of severely curved canals.

Vascular endothelial growth factor (VEGF) expression in human tooth germs early and later stage development

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Aim. The angiogenesis plays a crucial role in many human physiological and pathological processes during