# HyFlex®CM™ Abstracts

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## Bending Properties of a New Nickel-Titanium Alloy with a Lower Percent by Weight of Nickel

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**INTRODUCTION:** The aim of the present study was to evaluate the bending properties of Hyflex instruments, which exhibit a lower percent in weight of nickel (52 Ni %wt) and compare them with other commercially available nickel-titanium (NiTi) rotary instruments.
**METHODS:** Ten instruments with tip size 25, 0.06 taper of each of the following NiTi rotary instrumentation techniques were selected for the study: Hyflex, EndoSequence, ProFile, Hero, and Flexmasters. All instruments from each group were tested for stiffness by comparing their bending moment when they attained a 45-degree bend. Experimental procedures strictly followed testing methodology described in ISO 3630-1. All data were recorded and subjected to statistical evaluation by using analysis of variance test. Statistical significance was set at $P < .05$.
**RESULTS:** Statistical analysis of the data revealed that Hyflex files were found to be the most flexible instruments, with a significant difference ($P < .05$) in comparison with the other instruments. Among the other files, a significant difference has been reported for EndoSequence instruments compared with ProFile, Hero, and FlexMaster ($P < .05$), whereas no significant differences have been reported among those 3 files ($P > .05$).
**CONCLUSIONS:** Results of the present study have illustrated an increased flexibility of the new NiTi alloy over conventional NiTi alloy, and they highlight the potential of the new manufacturing process.

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## Fatigue Testing of Controlled Memory Wire Nickel-Titanium Rotary Instruments

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**INTRODUCTION:** To improve the fracture resistance of nickel-titanium (NiTi) files, manufacturers have introduced new alloys to manufacture NiTi files and developed new

manufacturing processes. This study was aimed to examine the fatigue behavior of NiTi instruments from a novel controlled memory NiTi wire (CM Wire). Methods: Instruments of ProFile, Typhoon (TYP), Typhoon CM (TYP CM), DS-SS0250425NEYY (NEYY), and DS-SS0250425NEYY CM (NEYY CM) (DS Dental, Johnson City, TN) all size 25/.04 were subjected to rotational bending at the curvature of 35_ and 45_ in air at the temperature of 23_ _ 2_C, and the number of revolutions to fracture (Nf) was recorded. The fracture surface of all fragments was examined by a scanning electron microscope. The crack-initiation sites, the percentage of dimple area to the whole fracture cross section, and the surface strain amplitude (ea) were noted.

**RESULTS:** The new alloy yielded an improvement of over three to eight times in Nf of CM files than that of conventional NiTi files ($P < .05$). The vast majority of CM instruments (50%-92%) showed multiple crack origins, whereas most instruments made from conventional NiTi wire (58%-100%) had one crack origin. The values of the fraction area occupied by the dimple region were significantly smaller on CM NiTi instruments compared with conventional NiTi instruments ($P < .01$). The square (NEYY CM) versus the triangular (TYP CM) configuration showed a significantly different lifetime on CM wire at both curvatures ($P < .01$).

**CONCLUSIONS:** The material property had a substantial impact on fatigue lifetime. Instruments made from CM Wire had a significantly higher Nf and lower surface strain amplitude than the conventional NiTi wire files with identical design.

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## Effects of manufacturing techniques on cyclic fatigue and torsional properties of nickel-titanium rotary endodontic files

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**BACKGROUND:** Cyclic fatigue has been reported to be the most common cause of endontic rotary file separation. Tortional strain has been reported to be the most common cause of file separation in hand files and 2nd most common cause of separation in rotary files (Shen 2009). Several new manufacturing techniques have been developed in the last 5 years claiming to improve rotary files resistance to cyclic fatigue.

**METHODS:** Testing was done on 6 different files. Cyclic testing with a simulated curvature of 60 degrees with a 5mm radius of curvature, files were rotated at manufacturers' recommended rate and time was recorded until spearation and CTF calculated. Torsional testing was completed in accordance to ISO 3630-1. Motor was rotated at 2rpm until fracture occurred and computer calculated maximum torsional load and angular deflection.

**CONCLUSIONS:** Manufacturing methods can have a significant effect on fatigue ad torsional resistance. CM wire was found to significantly increase the number of cycles to failure copared to other files. The ability to reduce super elasticity in nickel titanium would seem to have

additional advantages in decreasing procedural errors by decreasing the unproporational forces created while instrumenting a curved canal.

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## Comparison of Autoclaving Effects on Torsional Deformation and Fracture Resistance of Three Innovative Endodontic File Systems

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**INTRODUCTION:** Recent innovative manufacturing techniques have produced nickel-titanium (NiTi) rotary instruments with reports of superior properties compared to standard NiTi files. These include: Profile® Vortex™ made from M-Wire™ (PV), Twisted Files™ (TF) and 10 Series™ files made from CM Wire™ (CM). Sterilization is recommended prior to use and is repeated if files are reused and/or carried forward between cases. The purpose for this study was to compare the effects of multiple autoclaving cycles on the torsional load resistance of these three new rotary endodontic files.
**METHODS:** PV, TF, and CM files (n=100; size 25/.04) were divided into five groups (n=20). Files were autoclaved for 1, 2, 3, and 7 sterilization cycles. A control group was not subjected to autoclaving. Files were tested in a torsiometer in general accordance with ISO 3630-1 standards. Torsional load and degrees of rotation to failure were recorded. Mean data were analyzed using Kruskal-Wallace/Dunn post hoc (P=0.05).
**RESULTS:** Autoclave cycles had no significant overall effect on file performance for any of the instrument systems tested. PV and CM displayed significantly greater resistance to torsional load than TF ($P<0.001$), but were not different from each other ($P>0.05$). Angular deflection for TF and CM was significantly higher than PV ($P<0.001$), with TF demonstrating greater deformation than CM ($P<0.05$).
**CONCLUSIONS:** Under the conditions of this study, repeated autoclaving did not affect torsional resistance for unused files of the systems evaluated. Additionally, CM Wire™ files may have a combined advantage of greater torsional strength and high deformation prior to failure.