

NEW INNOVATION IN ENDODONTIC THERAPY; ELECTRIC DISCHARGE MACHINING.

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Abstract

Background

Nickel titanium rotary files have become popular because of their superelastic behaviour that makes them the best choice for shaping curved root canals.¹ This is mainly because of the superelasticity of NiTi alloy, which provides increased flexibility and allows the instruments to effectively follow the original path of the root canal.² Despite the advantages related to the superelasticity, fracture of NiTi files due to torsional overloading or flexural fatigue remains a concern in clinical practice.^{3,4} Possible strategies to increase efficiency and safety of NiTi rotary files include an improvement in the manufacturing process, or the use of new alloys that provide superior mechanical properties.⁵ Recently, a series of proprietary thermomechanical processes have been used to optimize the microstructure of NiTi.^{6,7,8} A new HyFlex CM NiTi rotary files (Coltene Whaledent, Switzerland) with controlled shape memory were introduced. CM wire is obtained by thermally treating the NiTi wires to shift the austenite/ martensite transition temperature at about 50 °C so that a stable martensitic microstructure is allowed at the mouth temperature.⁹ This imparts to the files a high fatigue resistance and the possibility to be easily bent during use, recovering its original shape by heating above the transformation temperature.¹⁰ Recently, patented treatment is involved in the innovative manufacturing of new HyFlex EDM files (Coltene Whaledent, Switzerland). The main feature of these files is that they are manufactured via an electro discharge machining (EDM) process.¹¹⁻¹⁵ The present research evaluated cutting efficacy of a new innovation Hyflex EDM rotary file system manufactured by Electric Discharge Machining.

Keywords: Controlled Shape Memory, Electro Discharge Machining, Rotary NiTi file.

Case presentation

A female patient aged 32 years came to the OPD of department of Conservative Dentistry & Endodontics, Babu Banarasi Das College of Dental Sciences, Lucknow, India with a chief complaint of pain in her lower left and right back teeth region since 15 days. The physical build and gait of patient appeared normal. The medical history was not significant. On Intraoral examination, both the teeth 35 and 45 were tender on vertical percussion test. All vitality tests were positive for these two teeth. A diagnosis of acute apical periodontitis was made and confirmed by radiological examination of 35 and 45 tooth. Root canal therapy in 35 and 45 was opted as treatment of choice. A pre-instrumented canal scan at three levels i.e. coronal, middle and apical using Cone Beam Computed Tomography (I-Cat CB500, U.S.A.) of both the teeth was done at Raydent Imaging Centre, Lucknow. The exposure time was 23 seconds. Image analysis was done by Anatomage Software. After scan and image analysis, the measurements were taken on MPR screen and observations were laid down. The local anesthesia 2% (Lignocaine with adrenaline, 1:80,000, ICPA, Mumbai) was administered and access endodontic cavity was done under rubber dam

(Hygenic, Coltene Whaedent, U.S.A.) Working length was confirmed by RVG (Satelec X-mind dc, Italy) for both the teeth. Cleaning and shaping of the root canal was performed using Hyflex EDM files in 16:1 reduction Canal Pro C L Handpiece (Coltene Whaledent, Germany) according to manufacturer's instructions. First Hyflex EDM orifice opener ISO No.25 taper 0.12 was used at 400 rpm and 2.5 Ncm torque. Glide path was made by first by ISO No.10 K file followed by rotary hand file glide path file No.10 taper 0.05 at 300rpm and a torque value of 1.8 Ncm. Hyflex One File ISO no.25 was used for shaping the canal till the working length at 500 rpm and a torque of 2.5Ncm. . Glyde (Dentsply Malliefer, Switzerland) was used as lubricant with the file whenever it was worked into the canal. Copious irrigation with normal saline was done after instrumentation of the canal to flush out the debris. The canal preparation was finished using Hyflex EDM finishing file ISO no.40 taper 0.04 and ISO no. 50 taper 0.03 at a speed of 400rpm and torque value of 2.5Ncm. After the canal preparation, the patient was again subjected to CBCT scan. The values of remaining dentin thickness were evaluated at three levels i.e. coronal, middle and apical and mean value was taken out.

Observations and Result:

Table 1: Remaining dentin thickness (RDT) values in 35 tooth assessed using CBCT scan.

	Preinstrumented canal RDT	Postinstrumented Canal RDT
Coronal	3.33mm	5.00mm
Middle	2.13mm	4.88mm
Apical	1.13mm	1.97mm

Table 2: Remaining dentin thickness (RDT) values in 45 tooth assessed using CBCT scan.

	Pre-instrumented canal RDT	Postinstrumented Canal RDT
Coronal	3.12mm	4.55mm
Middle	2.15mm	2.68 mm
Apical	1.41mm	2.09 mm

Discussion-

By far, numbers of files are available commercially which are utilized to shape root canals and are manufactured from NiTi and are mechanically driven in continuous rotation. The new Hyflex EDM file system has been recently introduced by Coltene Whaldent. The main feature of these files is that they are manufactured via an electro discharge machining (EDM) process. The EDM is a noncontact machining procedure used in engineering for the manufacturing of parts that would be difficult to machine with conventional techniques.¹² High-frequency electrical discharges are generated between an electrode and the workpiece within a dielectric fluid. The electrical sparks cause a local melting and partially evaporation of small portions of material that are removed from this local area living a typical crater-like surface finish.¹⁴ Due to features like unaltered spark-machined surface and low microstructural degradation, the Hyflex EDM can be a new asset to endodontics especially for shaping severely curved root canals.

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