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To assess the impact of the rotary file systems Protaper Gold and Hyflex EDM on the apical foramen of mandibular molars

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Abstract

AIM: To assess the impact of the rotary file systems Protaper Gold and Hyflex EDM on the apical foramen of mandibular molars.

Materials and method: The study included 10 mandibular molars with a total of twenty mesial root canals. Access cavities were set up, and the working length at the apical foramen was determined. Protaper Gold (PTG) and Hyflex EDM were used in Group 1 and Group 2, respectively, for biomechanical preparation of the canals (n=10). It was instrumented up to file size #25/0.06. AF areas (A0, A1) were evaluated under 10X magnification both before and after instrumentation. Each canal's foraminal distortion was computed by deducting A1 from A0.

Results: In all instances, apical foraminal distortion was visible. Compared to Protaper Gold, Hyflex EDM system displayed the least amount of AF deformation. The amount of deformation that is produced may be significantly influenced by the alloy, taper and cross-section of the file.

Keywords: rotary file systems, Hyflex EDM, biomechanical preparation

Introduction

The majority of endodontists believe that endodontic treatment's most important step is the canal preparation process. A variety of filling materials or processes will likely work well in a canal that has been properly prepared. These intracanal treatments create an environment that is favourable for the beginning of healing by carefully removing the canal contents and the damaged dentin and creating a receptacle for the filling material. Any substance or process, however, may have problems if it hasn't been properly or adequately prepared.

Root canal therapy is indicated for teeth that exhibit signs and symptoms of irreversible pulpitis and pulpal necrosis. The typical method of doing an endodontic operation is via hand instrumentation. Hand instrumentation, though a common practise, can result in canal aberrations, perforations, inadequate cleaning, transportation, instrument failure and extended chair time. The introduction of nickel-titanium instruments altered the practise of endodontics in a highly advantageous way.

It was stated by Ingle (1973) that the WL must be 0.5 mm short of the external root surface, by Weine (1982) that it must be 1 mm short of the radiographic apex, by Guldener (1985) that it must be 0.5 mm short of the tooth length for necrotic teeth and should be 1 mm short for vital teeth, by Frank (1988) that it must be 0.5-1 mm short of the apex, etc. Regardless of the tooth's vitality, Langeland *et al*. emphasised that root canal preparation and obturation must terminate at the apical constriction.

Materials and method

The study involved twenty mesial root canals in ten extracted mandibular molars with fully grown roots. The teeth had no flaws, their root canals were not calcified, there was no internal or external root resorption, there were no prosthetic crowns or dental supports, no evidence of earlier endodontic therapy, and no abnormal canal morphology. The apical foramen dimensions were measured using preoperative images at 10X magnification (A0).

Endo Access bur, 21 mm size 2 (Dentsply Maillefer, Swiss made) and K-file (Mani, Utsunomiya, Tochigi, Japan) of size #10 hand files were used to produce initial canal patency to full working length (WL), visible at the apical foramen, and the WL was stablished at this length. The canals were randomly allocated into two groups (n=10):

Group 1: Protaper Gold (PTG) and Group 2: Hyflex EDM (HEDM). Instrumentation was carried out using the individual groups' file systems up to file size #25/0.06. The 10X image magnification was used to assess the apical foramen dimensions after procedure (A1).

The formula was used to calculate the apical foraminal distortion caused by instrumentation for each canal: Apical deformation = A1-A0. A value of '0' shows that there is no apical deformation, according to this formula.

Results

The preoperative AF areas did not significantly differ from one another. When compared to the Protaper Gold system, the postoperative AF deformation was much reduced when Hyflex EDM was used.

Discussion

The advantages of nickel-titanium rotary files over stainless-steel hand files include improved fracture resistance, reduced torsional and cyclic fatigue, quicker canal preparation, etc. Pro Taper Gold files are created using a procedure that gives them a golden shine. Pro Taper Gold files may appear slightly bent as a result of this proprietary processing. This is not a production flaw. Although the file can be easily straightened with just fingers, doing so is not necessary before using the file. The Pro Taper Gold file will adhere to the anatomy once it is inside the canal. Protaper Gold files have an increasingly tapered design that the manufacturer believes would boost cutting efficiency and safety. These files were made by utilizing sophisticated metallurgy. Convex triangle cross-section and progressive taper of these files are referred to as "Protaper" characteristics.

Hyflex EDM instruments are produced by Coltene Whaledent in Alstatten, Switzerland, using electro discharge machining. The material acquires a seemingly isotropic surface as a result, and this is said to increase the instrument's resistance to cycle fatigue and torsional stress. This instrument's special control memory system makes it easier to negotiate complex canal curvatures, resulting in less iatrogenic difficulties. It also shows reversion after heat sterilisation.

Clinical studies have linked apical expansion and deformation after instrumentation to the patient's post-operative discomfort and extrusion of debris or irrigant. Hence, minimal foraminal expansion during instrumentation is required. In our investigation, PTG demonstrated more post-instrumentation apical deformation than Hyflex EDM. The steeper taper (8%) in the apical 3 mm of the Protaper gold system may be the cause of its higher apical deformation.

Our research supported earlier studies that demonstrated significant apical foramen distortion occurs when instrumentation is performed at or above the apex. In a 2018 study, Silva Santos *et al*. employed a scanning electron microscope to evaluate the foraminal deformation brought on by rotating and reciprocating motions. They came to the conclusion that because both motions induced identical distortion of the apical foramen, kinematics did not contribute to that deformation.

According to Gustavo *et al*., mechanical, and manual NiTi patency manoeuvres generated equal apical foramen deformation.

Conclusion

Within the limitations of this study, it can be concluded that:

1. Hyflex EDM system showed the least apical foramen deformation compared to the Protaper Gold.
2. The alloy, taper, and cross-section of the file may all influence the amount of deformation produced.

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