Comparison of Shaping Ability of two Rotary Ni-Ti Systems

(An In Vitro Study)

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

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Dedication

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Contents

List Of Figures

List Of Tables

Introduction

Establishing an accurate diagnosis and developing an appropriate treatment plan are essential for successful root canal treatment. In addition to, applying knowledge of tooth anatomy and morphology, there are vital steps in the treatment process, which include, performing the debridement, disinfection, and obturation of the entire root canal system. The former is achieved by adequate cleaning and shaping. Adequate cleaning and shaping and establishing a coronal seal are cornerstones when it comes to proper treatment guidelines. The main aim of cleaning is to reduce the irritants, rather than total elimination.

The purpose of shaping is to facilitate cleaning and help develop a continuously tapering funnel from the canal orifice to the apex also to maintain the canal anatomy and conserve the tooth structure, since the root is weakened due to dentin removal from the canal walls.

In order to achieve adequate cleaning and shaping, a tapered shape of the canals is required. Using the traditional stainless steel instruments often fail to achieve this requirement. Modern rotary Ni-Ti systems have proven the capacity to maintain the root canal curvature; they are manufactured with various tapers that enable the achievement of a continuously tapered funnel shape canal preparation. Modern rotary Ni-Ti systems include the protaper universal Shaping files, featuring multiple tapers that cut dentin in specific canal zones with flexibility.

In recent years, the need for 3D canal shaping and reduced invasive treatments have increased, encouraging the use of one file, such as the Xp endo shaper.

Radiography is very useful at all stages of root canal treatment. Cone beam computed tomography is more accurate as compared to its conventional counterpart and measures can be done in any plane distortion free. The role of CBCT in the evaluation of the shaping ability of the rotary files systems greatly helps with ensuring a successful endodontic treatment.

Review of literature

Hubscher et al [(1)] evaluated the relative performance of FlexMaster nickel-titanium instruments shaping maxillary molar root canals. Extracted human maxillary molars were scanned, before and after canal shaping, with FlexMaster, employing micro-computed tomography. Canals were three-dimensionally evaluated for volume, surface area, 'thickness' (diameter), canal transportation and prepared surface. Volume and surface area increased significantly and similarly in mesiobuccal, distobuccal and palatal canals; no gross preparation errors were found. FlexMaster instruments shaped both the curved and narrow canals in maxillary molars to sizes 40 and 45 with no significant shaping errors.

Calberson et al [(2)] studied the shaping ability of ProTaper nickel-titanium files in simulated resin root canals. 40 canals with 4 different shapes in terms of angle and position of curvature were enlarged with the finishing files F1, F2 and F3 to full working length. Preoperative and postoperative pictures were recorded using a digital camera. Superimposition and aberration images were recorded as well. Measurements were carried out at 5 different points at the canal orifice (O); half-way to the orifice in the straight section (HO); beginning of the curve (BC); apex of the curve (AC); end-point (EP). ProTaper instruments performed acceptable tapered preparations in all canal types. When using the F2 and F3 in curved canals, care should be taken to avoid excessive removal at the inner curve leading to danger zone. In addition Care should be taken to avoid deformation of the F3 instrument.

Luo et al [(3)] evaluated the shaping ability of multi-taper nickel-titanium files in simulated resin curved root canal by studying the shaping ability of ISO standard stainless steel K files and multi-taper ProTaper nickel-titanium files. 30 simulated resin root canals were divided into 3 groups and prepared by stainless steel K files, hand ProTaper, rotary ProTaper, respectively. The material removed from inner and outer wall and canal width after canal preparation was measured, while the canal curvature before and after canal preparation were recorded. The stainless steel K files removed more material than hand ProTaper and rotary ProTaper at the outer side of apex and inner side of curvature. The mean degree of straightening in stainless steel K files group was significantly bigger than in ProTaper group. The canals prepared by ProTaper had no evident aberration, so the shaping ability of ProTaper was better than stainless steel K files.

Schafer et al [(4)] compared the effectiveness of cleaning and shaping ability of Mtwo, K3, and RaCe nickel–titanium rotary instruments during the preparation of curved root canals in extracted human molars. A total of 60 root canals of mandibular and maxillary molars with curvatures ranging between (25° and 35° degrees) were divided into three groups of 20 canals. Canals were prepared using a low-torque motor. With the use of pre- and post-instrumentation radiographs, straightening of the canal curvatures was determined with a computer image analysis program. During preparation no instrument fractured. Completely clean root canals were never observed. Under the conditions of this study, Mtwo instruments resulted in good cleaning and maintained the original curvature significantly better than K3 or RaCe files.

Hong et al [(5)] evaluated the shaping ability between various hybrid instrumentation methods with ProTaper. ProTaper S1 and K-Flexofile (group S), ProTaper S1 and HeroShaper (group H), and ProTaper S1 and ProFile (group P), respectively. The ProTaper alone method (group C) was introduced as a control group. After canal preparation, the images of pre and post-operative canal were scanned and superimposed. Centering ratio and the width of the instrumented were measured at apical 1, 2 and 3 mm levels and statistical analysis was performed. The centering ratio of group P was preferable to ProTaper alone method or the hybrid technique using stainless steel files. The hybrid methods of each the Profile system and HeroShaper with ProTaper are recommendable comparative to ProTaper alone method. According to the results, the hybrid instrumentation more