
بسم الله الرحمن الرحيم
﴿ وَأَنزَلَ اللَّهُ عَلَيْكَ الْكِتَابَ وَالْحِكْمَةَ وَعَلَّمَكَ مَا لَمْ تَكُن تَعْلَمُ وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا ﴾
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ASSESSMENT OF INNOVATIVE ROOT CANAL ENLARGEMENT TECHNIQUES USING PROTAPER NI-TI SYSTEMS

(An In Vitro Study)

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By

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List of Contents

Title	Page No.
List of Tables	ii
List of Figures	iv
Introduction	1
Review of Literature	
1- Cleaning of root canal system	3
2-Shaping of root canal system	12
Aim of the study	41
Material and Methods	42
Results	53
Discussion	110
Summary and conclusions	117
Recommendations	120
References	121
Arabic Summary	--

List of Tables

Table No.	Title	Page No.
Table (1):	Showing sequence of canal preparation using full set of Protaper.	46
Table (2):	Values of transportation in different groups at different levels.	54
Table (3):	Values of transportation in different groups at 1.5 mm level.	56
Table (4):	Values of transportation in different groups at 3 mm level.	58
Table (5):	Values of transportation in different groups at 5 mm level.	60
Table (6):	Values of transportation in different groups at 8mm level.	62
Table (7):	Values of Transportation within the 4 different levels of the protaper group.	64
Table (8):	Values of Transportation within the 4 different levels of the F2 file in reciprocating motion group.	66
Table (9):	Values of Transportation within the 4 different levels of the F2 file in continuous motion group.	68
Table (10):	Values of centering ratio in different groups at different levels.	70
Table (11):	Values of centering ratio at 1.5mm level.	72
Table (12):	Values of centering ratio at 3 mm level.	74
Table (13):	Values of centering ratio at 5 mm level.	76
Table (14):	Values of centering ratio at 8 mm level.	78
Table (15):	Values of centering ratio within the 4 different levels of Protaper full thickness group.	80
Table (16):	Values of centering ratio within the 4 different levels of F2 file in reciprocating motion group	82
Table (17):	Values of centering ratio within the 4 different levels of F2 file in continuous motion group.	84
Table (18):	Values of percentage of debris in different groups at different levels.	92

List of Tables (Cont...)

Table No.	Title	Page No.
Table (19):	Values of percentage of debris in different groups at the coronal level.	94
Table (20):	Values of percentage of debris in different groups at the middle level.	96
Table (21):	Values of percentage of debris in different groups at the apical level.	98
Table (22):	Values of total percentage of debris in different groups.	100
Table (23):	Values of total percentage of debris at the different levels in the Protaper regular sequence group.	102
Table (24):	Values of total percentage of debris at the different levels in the F2 file in reciprocating motion group.	104
Table (25):	Values of total percentage of debris at the different levels in the F2 file in continuous motion group.	106

List of Figures

Fig. No.	Title	Page No.
Fig. (1):	Showing Protaper regular sequence (SX-F2) and in between brackets size and taper.	42
Fig. (2):	Showing 14 specimens aligned in arch shape in rubber base impression.	44
Fig. (3):	(A) and (B) showing Preoperative and postoperative scanning with CBCT.	48
Fig. (4):	Showing steps of tracing of debris under Stereomicroscope.	51
Fig. (5):	Mean values of transporation in different groups at different levels.	54
Fig. (6):	Mean values of transporation in different groups at 1.5mm.	56
Fig. (7):	Mean values of transporation in different groups at 3 mm.	58
Fig. (8):	Mean values of transporation in different groups at 5 mm.	60
Fig. (9):	Mean values of transporation in different groups at 8 mm.	62
Fig. (10):	Mean values of transporation within the 4 different levels of the protaper group.	64
Fig. (11):	Mean values of transporation within the 4 different levels of the F2 in reciprocating motion group.	66
Fig. (12):	Mean values of transporation within the 4 different levels of the F2 in continuous motion group.	68
Fig. (13):	Mean values of centering ratio in different groups at different levels.	70
Fig. (14):	Mean value of centering ratio at 1.5mm level.	72
Fig. (15):	Mean values of centering ratio at 3 mm level.	74
Fig. (16):	Mean values of centering ratio at 5 mm level.	76
Fig. (17):	Mean values of centering ratio at 8 mm level.	78
Fig. (18):	MeanValues of centering ratio within the 4 different levels of Protaper regular sequence group.	80
Fig. (19):	Mean values of centering ratio within the 4 different levels of F2 file in reciprocating motion group.	82

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. (20):	Mean values of centering ratio within the 4 different levels of F2 file in continuous motion group	84
Fig. (21):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 1.5mm for Protaper group	85
Fig. (22):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 1.5mm for F2 in reciprocating motion group.	85
Fig. (23):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 1.5mm for F2 in continuous rotation group.	86
Fig. (24):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 3mm for Protaper group.	86
Fig. (25):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 3mm for F2 in reciprocating motion group.	87
Fig. (26):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 3mm for F2 in continuous rotation group.	87
Fig. (27):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 5mm for Protaper group.	88
Fig. (28):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 5mm for F2 in reciprocating motion group.	88
Fig. (29):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 5mm for F2 in continuous rotation group.	89
Fig. (30):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 8mm for Protaper group.	89

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. (31):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 8mm for F2 in reciprocating motion group.	90
Fig. (32):	(A) & (B) showing preoperative and postoperative measurements of transportation and centering ratio respectively at 8mm for F2 in continuous rotation group.	90
Fig. (33):	Mean values of percentage of debris in different groups at different levels.	92
Fig. (34):	Mean values of percentage of debris in different groups at the coronal level.	94
Fig. (35):	Mean value of percentage of debris in different groups at the middle level.	96
Fig. (36):	Mean values of percentage of debris in different groups at the apical level.	98
Fig. (37):	Mean values of total percentage of debris in different groups.	100
Fig. (38):	Values of total percentage of debris at the different levels in the Protaper regular sequence group.	102
Fig. (39):	Mean values of total percentage of debris at the different levels in the F2 file in reciprocating motion group	104
Fig. (40):	Mean values of total percentage of debris at the different levels in the F2 file in continuous motion group.	106
Fig. (41):	Showing debris in the coronal section in Protaper group	107
Fig. (42):	Showing debris in the coronal section in F2 in reciprocating motion group.	107
Fig. (43):	Showing debris in the middle section in Protaper group.	108
Fig. (44):	Showing debris in the middle section in F2 in reciprocating motion group.	108
Fig. (45):	Showing debris in the apical section in Protaper group	109
Fig. (46):	Showing debris in the apical section in F2 in reciprocating motion group.	109

INTRODUCTION

The main aim of endodontic treatment is performing effective cleaning and shaping[(1)] in order to meet the required biological and mechanical objectives.

This is achieved by total removal of pulp tissue, debris and bacteria in addition to proper shaping of the root canal system[(2)]. This also provides adequate space for obturation[(3)] to properly seal the root canal system and reduce the chance for microleakage.

It is quite obvious that mechanical preparation of tortuous & severely curved canals presents a great challenge to endodontists.

Preparing such canals using rigid stainless steel files resulted in several procedural errors such as: zips, transportations and perforations. In addition to other drawbacks as: time consumption and operator fatigue.

The use of rotary nickel-titanium has revolutionized root canal preparation in an attempt to avoid the drawbacks of stainless steel hand files. They have several advantages such as: flexibility, super elasticity, time saving, decrease operator fatigue and the ability to maintain original canal path with low tendency towards canal transportation[(4)].

On the other hand, the major problem encountered with rotary Ni-Ti is sudden fracture due to flexural fatigue upon repeated use or torsional failure as the instrument tip is locked while handpiece continues to rotate. Failure induced by torsional shear stresses occurs when torsional shear stresses exceed the limit of the alloy leading to plastic deformation and eventual fracture. Various aspects might contribute to increase these stresses such as; excessive pressure on handpiece, wide area of contact between canal walls and cutting edge of the instrument or if canal dimension is smaller than the dimension of non-cutting tip of the instrument which leads to taper lock specially with instruments having regular taper[(4)]. A new technique for root canal preparation has been recently introduced which is using reciprocation. Reciprocating motion minimizes torsional flexural stresses, increases the canal centring ability and reduces the taper lock of the instrument in the canal wall[(4)]. Also time for preparing curved root canals with the use of single-file is reduced and infection control is improved.

Therefore conducting a study to evaluate canal transportation, centering ability and amount of debris on dentin wall was thought to be of value.

REVIEW OF LITERATURE

1- Cleaning of root canal system:

Proper cleaning of the whole root canal space have been recognized as a real challenge that is complicated by the anatomical complexities of the root canal systems as well as the physical limitations of the root canal instruments. Several instruments and techniques have been advocated to achieve this optimal goal with promising results.

Foschi et al 2004[5] evaluated root canal walls following the use of Mtwo and Protaper Ni-Ti rotary instruments using scaning electron microscopy (SEM). A total of 24 single rooted, human maxillary teeth of similar length were selected. They were divided into two equal groups: Group M prepared with Mtwo, group P prepared with Protaper instruments. After canal preparation each sample was split into two halves with stainless steel chisel and observed with SEM. The absence or presence of smear layer, pulpal debris and inorganic debris were rated and scored on 4 appearances using a predefined scale and selected SEM images. Results showed that both instruments produced a clean and debris free surfaces in the coronal and middle thirds but were unable to produce dentin surface free from smear layer and debris in the apical third.

Shäfer and Vlassis 2004[6] compared between Protaper and Race as regarding cleaning effectiveness and shaping ability during preparation of severely curved root canals of extracted teeth. A total of 48 maxillary and mandibular molars with curvatures ranging between 25◦ and 35◦ were divided into two equal groups. Canals were prepared using crown-down preparation technique. After each instrument canals were flushed with a 5ml of 2.5% NaOCl solution and also at the end of instrumentation. Based on the canal curvatures assessed prior to and after instrumentation, canal straightening was also determined. After splitting the roots longitudinally, the amount of debris and smear layer was quantified on the basis of a numerical evaluation scale using scanning electron microscope. Results showed that completely clean root canals were never observed. For debris removal, Race files achieved better results than Protaper. The results for smear layer were similar. Race instruments maintained the original canal curvature better than Protaper.

Liu et al 2006[7] compared cleaning efficacy and shaping ability of engine-driven ProTaper and GT files, and manual preparation using K-Flexofile instruments in curved root canals of extracted human teeth. Forty-five canals of maxillary and mandibular molars with curvatures between 25 degrees and 40 degrees were divided into three groups according to the angle and

the radius of canal curvature. The double-exposure radiographic technique was used to investigate apical transportation. The time required to complete the preparation, as well as any change in working length after preparation were recorded. The roots were then grooved and split longitudinally. The amounts of debris and smear layer were evaluated at the apical, middle and coronal regions under the scanning electron microscope. Results showed that as regarding debris removal, ProTaper achieved a better result than GT but not the K-Flexofile group at all three regions (apical, middle and coronal). Also they found that K-Flexofiles produced significantly less smear layer than ProTaper and GT files only in the middle third of the canal. Both NiTi rotary instruments maintained the original canal shape better than the K-Flexofiles and required significantly less time to complete the preparation.

Yang et al2008[8] evaluated the amounts of debris and smear layer remaining on canal walls after preparation with Protaper and HeroShaper instruments in combination with NaOCl and EDTA irrigation in curved root canals. A total of 55 root canals were randomly divided into 2 instrumentation groups of 20 canals each and one negative control group of 15 canals. The canals in each of the 2 instrumentation groups were prepared with Protaper and HeroShaper, while the control group was not instrumented. Debris and smear layer were evaluated using SEM at x200 and x1000 at coronal, middle and