



Shaping Ability and Canal Cleanliness of Different Rotary Nickel Titanium Systems.

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By

Esraa Ahmed Rahhal

B.D.S Sanaa University -Yemen (2009)

Endodontic Department

Faculty of Dentistry

Ain Shams University

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Supervised by

Dr. Abeer Abdelhakim El Gendy

Professor of Endodontics

Endodontic Department

Faculty of Dentistry

Ain Shams University

and

Dr. Shady Ali Hussein

Lecturer of Endodontics

Endodontic Department

Faculty of dentistry

Ain Shams University

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَقُلْ أَعْمَلُوا فَسِيرَی اللَّهِ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ وَسَتُرَدُّونَ إِلَى
عِلْمِ الْغَيْبِ وَالشَّهَادَةِ فَيُنَبِّئُكُمْ بِمَا كُنتُمْ تَعْمَلُونَ ﴿١٠٥﴾

صَدَقَ اللَّهُ الْعَظِيمُ

سورة التوبة

Dedication

*Every challenging work needs self efforts as well as
guidance of elders especially those who very close to our
heart.*

*My humble effort I dedicate to my sweet and loving
Father & Mother,
Whose affection, love, encouragement and prays of day
and night make me able to get such success and honor,
Along with all hard working and respected
Teachers.*

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List of Contents

List of figures.....	VII
List of tables.....	XI
List of abbreviations.....	XII

Introduction	1
Review of literature	3
I- Shaping ability	3
II- Cleaning ability	19
Aim of Study	31
Materials and Methods.....	32
1. Instruments& Materials	32
2. Methods	34
Part I (Shaping Ability).....	40
Part II (Cleaning Efficacy).....	51
Results.....	57
Part I (Shaping Ability).....	57
Part II (Cleaning Efficacy)	85
Discussion	90
Summary and Conclusion	105
References	107

Arabic summary.....	
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List of Figures

<i>Figure No.</i>	<i>Title</i>	<i>Page No.</i>
1	Photograph showing sectioning of the distal root and flattening of occlusal table.	35
2	CBCT imaging system.	37
3	Schematic drawing of how degree of curvature determined by Schneider's method.	37
4	CBCT image with sharpest sagittal section using Schneider ⁽¹⁾ curve angle determination method.	37
5	Schematic diagram showing sample classification.	39
6	Arrangement of the samples in a specially fabricated cartoon box with their buccal sides oriented to the same direction.	41
7	Schematic diagram showing measurements for image cross section to be used in the Gambill's ⁽⁴⁾ equation.	42
8	CBCT image for pre-instrumentation measurement of dentin thickness in mesiodistal and buccolingual direction at coronal level (8 mm from the apex).	43
9	CBCT image for pre-instrumentation measurement of dentin thickness in mesiodistal and buccolingual direction at middle level (5 mm from the apex).	43
10	CBCT image for pre-instrumentation measurement of dentin thickness in mesiodistal and buccolingual directions at apical level (2 mm from the apex).	43
11	Photograph showing the TFAaptive motor (Element).	45
12	CBCT axial sections pre-and post-instrumentation at multiple levels.	49
13	CBCT image of post-instrumentation measurement of dentin thickness in mesiodistal and buccolingual direction at coronal level (8 mm from the apex).	50
14	CBCT image of post-instrumentation measurement of dentin thickness in mesiodistal and buccolingual direction at middle level (5 mm from the apex).	50
15	CBCT image of post-instrumentation measurement of dentin thickness in mesiodistal & buccolingual direction at apical level (2 mm from the apex).	50

16	Schematic drawing showing longitudinal section of the mesial root of mandibular molar for evaluation of canal cleanliness in mesio-buccal canal at coronal, middle and apical third	52
17	CCD digital camera mounted on zoom stereomicroscope.	54
18	Steps of image analysis for calculation debris area inside the canal.	55
19	Bar chart representing mean angle of canal curvature for pre and post instrumentation after using different systems.	58
20	Bar chart representing comparison between % changes in canal curvature for Three Systems	58
21	Bar chart representing the effect of file type on Canal Transportation in Mesio-Distal direction.	61
22	Bar chart representing the effect of Canal Third on Canal Transportation in Mesio-Distal direction.	61
23	Bar chart representing the effect of file type on Canal Transportation in Bucco-lingual direction.	64
24	Bar chart representing the effect of Canal Third on Canal Transportation in Bucco-lingual direction.	64
25	Bar chart representing comparison between Mesio-Distal and Buccolingual direction of canal transportation after using of TFAdaptive at three levels	68
26	Bar chart representing comparison between Mesio-Distal and Buccolingual direction of canal transportation after using of TF at three levels	68
27	Bar chart representing comparison between Mesio-Distal and Buccolingual direction of canal transportation after using of ProTaperNext at three levels.	68
28	Bar chart representing file type effect on centering ratio in Mesio-Distal direction.	71
29	Bar chart representing Canal third effect on Centering Ratio in Mesio-Distal direction.	71
30	Bar chart representing file type effect on centering ratio in Bucco-lingual direction	74

31	Bar chart representing Canal third effect on Centering Ratio in Bucco-lingual direction.	74
32	Bar Chart representing Comparison between the Mesiodistal and Buccolingual Direction for Centering Ratio of TFAaptive	78
33	Bar Chart representing Comparison between the Mesiodistal and Buccolingual Direction for Centering Ratio of Twisted File	78
34	Bar Chart representing Comparison between the Mesiodistal and Buccolingual Direction for Centering Ratio of ProTaper Next	78
35	CBCT Image of a sample prepared using PTN showing transportation in buccolingual direction at apical third level (2mm from apex) (a)pre- instrumentation, (b)post-instrumentation	79
36	CBCT Image of a sample prepared using TF showing transportation in mesiodistal direction at middle third level (5mm from apex) (a)pre- instrumentation, (b)post-instrumentation	80
37	CBCT axial sections pre-and post-instrumentation dentin thickness at multiple levels for a sample from TFA group.	81
38	CBCT axial sections pre-and post-instrumentation dentin thickness at multiple levels for a sample from TF group.	82
39	CBCT axial sections pre-and post-instrumentation dentin thickness at multiple levels for a sample from PTN group	83
40	Bar chart representing effect of file type on cleaning efficacy.	86
41	Bar chart representing effect of canal third on cleaning efficacy.	86
42	Stereomicroscope images for one sample prepared using PTN. (a) Represents image of coronal third, (b) middle third and (c) apical third.	87
43	Stereomicroscope images for one sample prepared using TF group (a) represents image of coronal third, (b) middle third and (c) apical third	88

44	Stereomicroscope images for one sample prepared using from TFAadaptive group as an example. (a) Represents image of coronal third, (b) middle third and (c) apical third.	89
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List of Tables

<i>Table No.</i>	<i>Title</i>	<i>Page No.</i>
1	Materials & instruments	34
2	Angle of Curvature (Mean, Standard deviation [SD]) For Different groups.	58
3	Mean and Standard Deviation (SD) of Dentin Thickness Removed for Different Groups in Mesiodistal Direction.	61
4	Mean and Standard Deviation (SD) of Dentin Thickness Removed for Different Groups in Bucco-lingual Direction.	64
5	Comparison between the Mesiodistal and Buccolingual Direction for the Amount of dentin Thickness Removed.	68
6	Mean (M) and Standard Deviation (SD) of Centering Ratio for different Groups in Mesio-distal direction.	71
7	Mean (M) and Standard Deviation (SD) of Centering Ratio for different Groups in Bucco-lingual direction.	74
8	Comparison between the Mesiodistal and Buccolingual Direction for Centering Ratio.	78
9	Mean (M) and Standard Deviation (SD) of debris percentages for different Groups.	86

List of abbreviations

TFA	TFAdaptive
TF	Twisted file
PTN	Protaper Next
PTG	Protaper Gold
PTU	Protaper Universal
WL	Working length
SM1	First file of TFAdaptive system (small kit)
SM2	Second file of TFAdaptive (small kit)
X1	First file of Protaper Next system
X2	Second file of Protaper Next system
RPM	Round per minute
CBCT	Cone Beam Computerized Tomography
FOV	Field of View
mA	milliAmpair
kv	kilo voltage
CCD	Charged Coupled Device
EDTA	Ethylene Diamine Tetra Acetic Acid
CW	Clockwise
CCW	Counter-Clock wise
M	mean
SD	Standard deviation
R-phase	Rhombohedral microstructure-phase
CR	Continuous Rotation
RM	Reciprocation motion

Introduction

Successful root canal treatment depends primarily on removal of microorganisms through chemo-mechanical instrumentation of root canal system. The use of endodontic instruments create dentine debris and a smear layer as a consequence of their action on root canal walls. Insufficient removal of debris and smear layer material can induce stresses on the cutting segment of endodontic instruments. Their removal depends not only on the irrigation method but also on the endodontic instrument.

Use of nickel-titanium (NiTi) alloy in endodontics has allowed the creation of newer instruments and preparation techniques that lead to less iatrogenic errors as ledging, zipping, canal transportation and apical blockage.

Movement kinematics is a factor has become important for better instruments regarding shaping ability and cleaning efficacy. Reciprocating motion is an evolution of balanced force technique that proved to maintain canal curvature with minimal distortion of root canal shape. The objectives of new motion were to improve safety of shaping. Kinematics regarding cleaning efficacy it was controversial if the reciprocating movement produces more apical debris extrusion and then continuous rotation. ⁽¹⁾

TF Adaptive instruments which allow not only rotary but also adaptive reciprocation motion which called adaptive motion

Introduction

have been launched recently .A micro motor dedicated to these instruments is programmed with a special algorithm which changes a rotary motion of given instrument into reciprocating motion when load during rotation increases. As a result the proprietary TFA motion has no predefined speed and has continuously adapting angles for reciprocation, resulting in a unique innovative smooth motion for endodontic NiTi instruments. ⁽²⁾

Hence the aim of the present study was to evaluate the newly introduced instruments Protaper Next & TFAdaptive regarding their shaping and cleaning ability.

Review of literature

II) Shaping Ability:

Over the years, NiTi alloys have become indispensable materials in endodontic treatment. With advancements in metallurgy, manufacturers have attempted to produce instruments with enhanced features ⁽³⁾. Twisted File multifile rotary system made by R-Phase treated NiTi with an equilateral triangular cross-section ⁽⁴⁾ used with clockwise (CW) continuous rotation (CR). Three new design methods of manufacturing, namely R-phase heat treatment, twisting of the metal, and special surface conditioning (deoxidation). These processes significantly increase the instrument resistance to fracture, provide greater flexibility, and maintain the sharpness of the flutes ^{(5), (6)}.

The ProTaper Next system is (M-wire based) NiTi alloy and, three instruments system, executing an asymmetric rotary motion and variable taper design within each instrument and also possesses unique offset mass of rotation. All these features enable PTN to cut larger sections compared with similar sized files and decrease the screw effect and taper lock by decreasing contact area between the instrument and the dentin wall of root canal.

Twisted File Adaptive system recently has been introduced. This system includes a specific sequence of Twisted File instruments activated by adaptive motion (AM) which include the use of specialized motor that switches the motion between continuous rotary or reciprocating motion based on frictional intracanal stress and load generated on the instrument. In other words a continuous rotation is initiated with minimal or no load, and the reciprocal motion is initiated when the instrument engages the dentin and when the load is applied by the operator ⁽⁷⁾.

Ozgur et al. 2006 ⁽⁸⁾ investigated several parameters of root canal preparation with three different rotary NiTi systems: Hero Shaper, ProTaper, and RaCe. The parameters evaluated were: changes in root canal volume and cross-sectional area, canal