سورة البقرة الآية: ٣٢

In Vitro Comparison of Cyclic Fatigue Resistance of Revo-s& One- Shape in Straight and Curved Canals

Thesis

Submitted to the Faculty of Dentistry, Ain Shams University

For

Partial fulfillment of the requirements of Master Degree in Endodontics

By

Walaa Fawzy Amin

B.D.S

(Ain Shams University, 2006)

Supervisors

Dr. Kariem Mostafa El Batouty

Professor in Endodontics
Department of Endodontics
Faculty of Dentistry, Ain Shams University

Dr. Mohamed Mokhtar Nagy

Lecturer in Endodontics
Department of Endodontics
Faculty of Dentistry, Ain Shams University

2017

Dedication

To my parents soul

To my sisters and brothers

Acknowledgement

*All thanks to **ALLAh** whom give me this success*

*I would like to express my deep gratitude and my deep appreciation to **Prof. Dr.Kariem El Batouty** Professor of Endodontics for his valuable guidance and effort throughout my work.*

*I am proud to be supervised by **Dr. Mohamed Mokhtar** Lecturer of Endodontics, for his sincere help, co-operation and helpful remarks during this study.*

My deep gratitude to all staff members of endodontic department of Ain Shams university .

List of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	**Meaning**
Ni-Ti	Nickel Titanium
OS	Oneshape
WO	WaveOne
PTU	ProTaper Universal
PTX	ProTaperNext
CF	Cyclic Fatigue
R	Reciproc
HCM	HyflexCM
OS	Oneshape
SU	Shaping Universal
PTU	ProTaper Universal

TF	Twisted File
CT	Torsional stress
GF	Gentlefile
PTF2	Protaper F2
SD.	Standard deviation

Rotary nickel-titanium instruments have a very wide popularity because it seems to be safe when used according to the manufacturer guidelines, they had the ability to enlarge root canals rapidly, and are well suited to prepare severely curved root canals.Ni-Ti instruments have increased flexibility, wider elastic limits and superior resistance to bending and torsional failure. They suitable for negotiating curved canals and reduce the risk of transportation, zipping, stripping or ledging the canal. They produce more effective biomechanical preparation. They also provide superior canal centering ability and reduced preparation time.

Fracture of Ni-Ti instruments occur when the instrument rotates within the elastic limits in curved canal, every bent portion of the instrument is subjected to alternating cycles of compression and tensile stresses.Continous repetition of such stresses leads to low cyclic fatigue of the instrument.

Fracture of instruments used in rotary motion occurs in two different ways: fracture caused by torsion and fracture caused by flexural fatigue. Torsional fracture occurs when an instrument tip or another part of the instrument is locked in a canal while the shank continues to rotate. When the elastic limit of the metal is exceeded by the torque exerted by the hand piece, fracture of the tip becomes in evitable.

Fracture caused by fatigue through flexure occurs because of metal fatigue. The instrument does not bind in the canal, but it rotates freely in a curvature, generating tension/compression cycles at the point of maximum flexure until the fracture occurs. In addition, rotation in this curved posture subject the file to hundreds of cycles of

alternating compression and flexure. Memory characteristics and phase transition of NiTi impart the ability to cycle through the bending demands of a curved canal without fracturing.

The resistance to fatigue fracture of rotary Ni-Ti instruments may be affected by the geometric features of the root canal, canal curvature, canal diameter and the instrument itself .Also the number of time to use can affect the fatigue resistance as the more cycles of compression and tension the more the material fatigue.

Based on the above facts, it was thought that single-file systems may have higher cyclic fatigue resistance in comparison to multiple files system, as it is subjected to low number of compression and tension cycles. But the knowledge gap still present between both systems because there are other factors affecting the cyclic fatigue of the rotary Ni-Ti endodontic instruments.

Separation of rotary Ni-Ti instruments occurs due to torsional failure or flexural fatigue. Whether the fracture occurs due to the influence of one of them or due to combined effect, yet cyclic fatigue is proved to be an important reason for instrument separation during clinical use. In this part of the study we will discuss the difference between the cyclic fatigue of single system and multiple system, effect of mode of motion, effect of methods of fabrication, angle of canal curvature and number of usage on cyclic fatigue.

I. Effect of multiple file systems versus single file systems on cyclic fatigue:

A. Multiple file systems:

Pedulla et al.[1] assessed the resistance to cyclic fatigue of three nickel titanium files after the immersion in sodium hypochlorite solution in conditions similar to those used in clinical practice. They used 150 new Twisted Files, Revo S SU files and Mtwo files, size 25.06. Fifty files of the same brand were randomly assigned to five groups (n = 10) and submitted to the following immersion protocol in 5% NaOCl at 37°C for 16 mm: no immersion (control), 5 minutes statically, 1 minute statically, 5 minutes dynamically (300 rpm/min), and 1 minute dynamically, they found that resistance to cyclic fatigue of the same niti file was not significantly affected by immersion in NaOCl. The Twisted file showed a higher resistance in all groups than Revo- S SU. The comparison between the same groups of Twisted files and Mtwo files or between Mtwo and Revo S files did not show significant differences except for two