

Efficiency of Two Types of Rotary Ni-Ti Retreatment Files in Removal of Gutta- Percha. An In-Vitro Study

Thesis submitted to the Faculty of Dentistry, Ain Shams
University for the partial fulfillment of requirements of
the Master degree in Endodontics

By

Ahmed Mohammed Osama Olish

*B.D.S Ain Shams University
(2005)*

Department of Endodontics

Faculty of Dentistry

Ain Shams University

2015

Supervisors

Prof Dr. Ehab El-Sayed Hassanin

*Chairman of Endodontics Department, Faculty of Dentistry, Ain
Shams University*

Ass. Prof. Dr. Kariem Mostafa El-Batouty

*Associate professor of Endodontics, Endodontics Department,
Faculty of Dentistry, Ain Shams University*

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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

صدق الله العظيم
سورة البقرة الآية (32)

Acknowledgment

*I wish to express my deepest gratitude and sincere appreciation to **Prof. Dr. Ehab El-Sayed Hassanin** Chairman of the Department of Endodontics Faculty of Dentistry -Ain Shams University. His guidance and collaboration helped me to overcome the obstacles and difficulties that arose along the way until my thesis got completed.*

*I would like to thank **Ass. Prof. Dr. Kareim Mostafa El –Batouty** Associate Professor of Endodontics Faculty of Dentistry -Ain Shams University for offering me much of his time, effort and support throughout the whole work.*

*I would like to thank all the **Staff of the Department of Endodontics** Faculty of Dentistry Ain Shams University for their unlimited support*

Dedication

First of all To ALLAH the Merciful, who helped me and guided me along my journey.

To my mother, I wish you could be here; you made me on what I'm.

To my father, no words could describe how thankful I'm to you.

To my wife the greatest women in my life for your unlimited support.

To my lovely daughter, I wish you all the best in your becoming life.

To all my family and friends for their unconditional love and support.

List of contents

List of abbreviations	ii
List of figures	iii
List of tables	vi
Introduction	1
Review of literature	4
I- Non surgical root canal retreatment versus surgical root canal retreatment	4
II- Importance of total removal of gutta-percha filling material	5
III- Methods of removal of gutta-percha filling material.....	7
IV- Ni-Ti rotary systems and their efficiency in gutta-percha removal	8
V- Fracture of Ni-Ti instrument	25
Aim of the study	30
Materials and methods.....	31
1) Materials	31
2) Methods	33
Results	46
Discussion	82
Summary and conclusion	91
References	94
Arabic summary	

List of abbreviations

NaOCl	Sodium hypochlorite
EDTA	ethylene diamine –tetra-acetic acid
G.P	gutta-percha
Ni-Ti	Nickel titanium
RaCe	Reamer with alternative cutting edges
G.G	Gates-Glidden
O.S.M	optical stereomicroscope
SEM	Scan electron microscope
CBCT	cone beam computed topography
SAF	Self adjusting file
SME	Shape memory effect
SE	Super elasticity
TTR	Transformation temperature range
DSC	Differential scanning calorimetric

List of figures

Figure no.	Title	Page
Figure 1	R-Endo file. The figure shows name, tip size, taper, the length of the working blade.	31
Figure 2	D-race retreatment file the figure shows the name of the file and the tip design.	32
Figure 3	Diagram demonstrating the samples classification	35
Figure 4	Diagram demonstrating samples classification of the retreatment files.	41
Figure 5	Scan electron microscope	43
Figure 6	Column chart showing the differences in time needed for retreatment between D-RaCe and R-Endo.	48
Figure 7	Column chart showing differences in the percent of the remaining filling material for D-RaCe and R-Endo group after single and 5 uses. .	50
Figure 8	Column chart showing differences in the percent of the residual filling material surface area between D-RaCe and R-Endo.	52
Figure 9	Stereomicroscope after the first use showing less residual filling material in the root retreated with D-RaCe compared with the root retreated with R-Endo in the apical, middle and coronal thirds.	55
Figure10	Stereomicroscope after 5 uses showing less residual filling material in the root retreated with D-RaCe compared with the root retreated with R-Endo in the middle and coronal thirds. While the apical third the root retreated with R-Endo showed less remnants. The middle third in the D-RaCe groups showed the separated instrument.	56
Figure 11	Stereomicroscope after the first use showing similar amount of the residual filling material in the apical third in roots retreated with D-RaCe and R-Endo while the middle and coronal third the root retreated with R-Endo showed slightly less residual filling material.	57
Figure 12	Stereomicroscope after 5 uses showing less residual filling material in the root retreated with D-RaCe compared with the root retreated with R-Endo in the apical, middle and coronal thirds.	58

Figure 13	Stereomicroscope after single use showing less residual filling material in the root retreated with D-RaCe compared with the root retreated with R-Endo in the apical, middle and coronal thirds.	59
Figure 14	Stereomicroscope after 5 uses showing less residual filling material in the root retreated with D-RaCe compared with the root retreated with R-Endo in the apical, middle and coronal thirds.	60
Figure 15	SEM top view of DR2 (D-RaCe) sample 1 as received file showing metallic strips.	61
Figure 16	view of DR2 (D-RaCe) sample 2 as received file showing metallic strips.	61
Figure 17	SEM top view of R3 (R-Endo) sample 1 as received file showing metallic strips.	62
Figure 18	Column chart showing the metallic strips seen in SEM in D-RaCe and R-Endo.	63
Figure 19	SEM tilted view of DR2 (D-RaCe) sample 1 after first use showing disruption of the cutting edge.	64
Figure 20	SEM tilted view of R3(R-Endo) sample 2 after five uses showing disruption of the cutting edges.	65
Figure 21	Column chart showing the difference on the disruption of the cutting edge between D-RaCe and R-Endo.	65
Figure 22	SEM tilted view of DR2 (D-RaCe) sample 2 after the first use showing micro fractures.	66
Figure 23	SEM top view R3 (R-Endo) sample 2 after five uses showing micro fracture	67
Figure 24	Column chart of the difference of micro fracture appearance between D-RaCe and R-Endo.	68
Figure 25	SEM tilted view R3 (R-Endo) sample 2 after five uses showing cracks.	69
Figure 26	Column chart showing difference of cracks seen in D-RaCe and R-Endo.	69
Figure 27	SEM top view of DR2 (D-RaCe) sample 2 after five uses showing fracture	70
Figure 28	Column chart showing the difference of the percent of fracture between D-RaCe and R-Endo.	71
Figure 29	SEM tilted view of DR2 (D-RaCe) sample 2 after the first use showing scrapping.	72

Figure 30	Column chart showing scrapping difference between D-RaCe and R-Endo.	73
Figure 31	Column chart showing the difference of pitting between D-RaCe and R-Endo.	74
Figure 32	SEM tilted view of DR2 (D-RaCe) after first use showing pitting.	74
Figure 33	SEM top view of R3(R-Endo) as received file showing pitting.	75
Figure 34	Column chart showing difference in crater incidence between D-RaCe and R-Endo.	76
Figure 35	column chart showing difference in corrosion incidence between D-RaCe and R-Endo	77
Figure 36	SEM top view of the DR2 (D-RaCe) sample 2 after the first use showing debris.	78
Figure 37	SEM top view of R3 (R-Endo) sample 1 after the fifth use showing debris.	78
Figure 38	Column chart showing differences between debris seen in SEM between D-RaCe and R-Endo.	79
Figure 39	SEM side view of DR2 (D-RaCe) sample 3 after the fifth use showing unwinding.	80
Figure 40	Column chart showing differnces of unwidining between D-RaCe and R-Endo.	81

List of tables

Table no	Title	Page no
Table 1	List of surface topographic defects.	44-45
Table	Mean and standard deviation of the time needed for retreatment with D-RaCe and R-Endo.	48
Table 3	Mean and standard deviation of the surface area of the residual filling material in D-RaCe group.	49
Table 4	Mean and standard deviation for the percent of the residual filling material of D-RaCe and R-Endo.	52
Table 5	Fisher exact test of the presence of metallic strips.	62
Table 6	Fisher exact test for the disruption of the cutting edge	65
Table7	Fisher exact test for the occurrence of microcracks.	67
Table 8	Fisher exact test for cracks in D-RaCe and R-Endo.	69
Table 9	Fisher exact test of the percent of fracture in D-RaCe and R-Endo	71
Table 10	Fisher exact test of scrapping seen in SEM in D-RaCe and R-Endo	72
Table 11	Fisher exact test of pitting seen in SEM in D-RaCe and R-Endo.	73
Table 12	Fisher exact test of crater seen in SEM in D-RaCe and R-Endo	76

Table 13	Fisher exact test of the corrosion seen in SEM in D-RaCe and R-Endo	76
Table 14	Fisher exact test for debris seen in SEM in D-RaCe and R-Endo	79
Table 15	Fisher exact test unwinding seen in SEM in D-RaCe and R-Endo	81

Root canal therapy despite having a high degree of success may not lead to the desired response and failure may occur. Recent publications reported failure rates of 14%–16% for initial root canal treatment. When root canal therapy fails treatment options include conventional retreatment, periradicular surgery or extraction. Whenever possible the retreatment option is preferred because it is the most conservative method to solve the problem.

The clinical success rate of endodontic retreatment has been estimated to vary between 50% and 90%, the variability of the outcome in endodontic retreatment is related to patient's age, the type of teeth treated, presence of alteration in natural course of the root canals, the possibility of removing the coronal restoration to access the pulp chamber and possibility of repairing pathologic and iatrogenic defects, preoperative perforations, apical periodontitis and quality of previous filling materials. The outcome of endodontic retreatment is depending on the effective elimination of necrotic tissue, bacteria, and infected obturation material such as gutta-percha and cements from root canal.

However, well-compacted filling material offers resistance to instruments and incomplete removal of gutta-percha and sealer limits the access to the apical foramen and impairs root canal disinfection and reshaping. Removal of root canal filling could be done by several techniques; first thermally heat-bearing

instruments, second chemically using different types of solvents; such as chloroform, eucalyptol, xylene, halothane, turpentine, or orange solvent, third ultrasonically and forth mechanically which could be done manually by the use of stainless steel hand files or engine driven by the use nickel-titanium (Ni- Ti) rotary system.

Several Ni-Ti systems were used in the retreatment such as Profile (Dentsply Maillefer, Ballaigues, Switzerland), Quantec, GT Rotary files, K3, RaCe (FKG Dentaire, La Chaux-de-Fonds, Switzerland), FlexMaster (VDW Antaeos, Munich, Germany) and ProTaper instruments (Dentsply Maillefer, Ballaigues, Switzerland). Recently several Ni-Ti rotary which are specially designed for the retreatment procedure have been introduced to the market such as ProTaper universal retreatment files(Dentsply Maillefer, Ballaigues ,Switzerland) , M-Two R(VDW, Munich, Germany), R-Endo(Micro-Mega, Basancon, France) and D-RaCe (FKG Dentaire, La Chaux-de-Fonds, Switzerland).

Since that there are several rotary Ni-Ti instruments in the market several studies were carried out for the evaluation of their efficiency in the removal of the root canal filling material, In these studies the evaluation was carried out on the bases of several factors; remnant of the filing material, post operative pain, apical extrusion of debris, effect on curvature and fractures of the uses instrument.

Based on these factors it was thought that the evaluation of the remaining amount of the root canal filling material on the root canal walls after retreatment with two different systems of Ni-Ti retreatment files is of value.